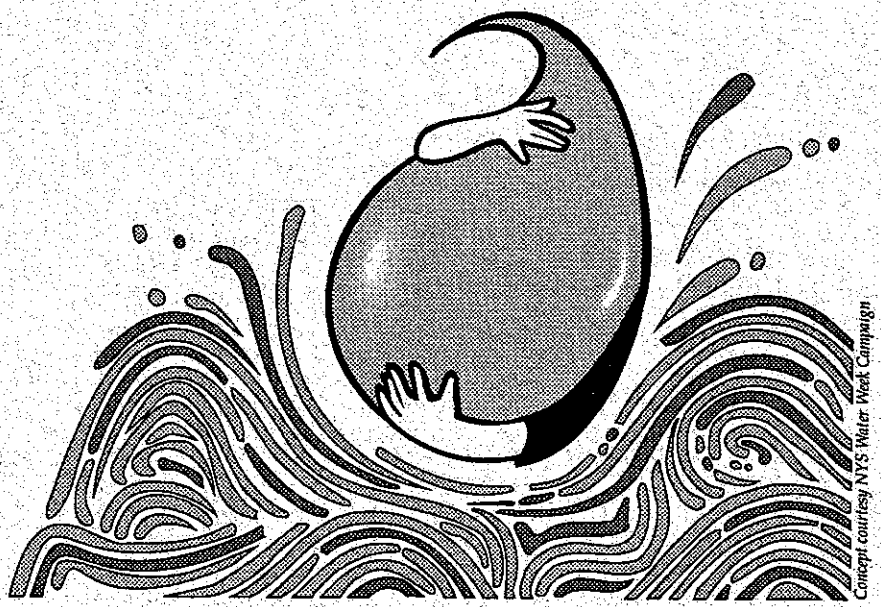

Water Conservation Planning Handbook

for Public Water Systems

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Washington State Department of Health

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CHAPTER 1: INTRODUCTION

Purpose of This Handbook

The Department of Ecology has prepared this Handbook, with the assistance of the Department of Health, to provide assistance to public water systems in developing water conservation plans. This Handbook is based on guidance presented in the Guidelines and Requirements for Public Water Systems Regarding Water Use Reporting, Demand Forecasting Methodology, and Conservation Programs written jointly by the Department of Health, Department of Ecology, and the Washington Water Utilities Council (hereafter referred to as the Conservation Planning Requirements). The Conservation Planning Requirements establish minimum water conservation plan requirements, specific data collection requirements, and demand forecasting methods for different sizes of public water systems. Plans submitted in response to the Conservation Planning Requirements will be reviewed and approved by the Department of Health, with Department of Ecology assistance, to determine compliance with those guidelines.

A water conservation plan will be required of a public water system either as an element in the water system plan or as a condition of a water right.

This Handbook is provided to assist public water systems in the development of a conservation plan that complies with the Conservation Planning Requirements. **This Handbook does not establish any additional requirements and will not be adopted as rule.** Public water systems are not required to use this Handbook. *Note: this Handbook is for water conservation planning, not curtailment or drought planning. See definition section (page 4) for clarification of these terms. Curtailment/drought information is available from the Department of Health.*

The Conservation Planning Requirements are a revised version of an earlier document entitled the Interim Guidelines for Public Water Systems Regarding Water Use Reporting, Demand Forecasting Methodology, and Conservation Programs. The Conservation Planning Requirements were revised by staff from the Department of Health, the Department of Ecology and members of the Washington Water Utilities Council.

Smaller public water systems which lack specialized staff and experience in water conservation are the target audience of this Handbook but the examples used and ideas expressed in this Handbook can be used by all public water systems. It is hoped that this Handbook will encourage public water systems to consider the creative ways conservation measures can be used to reduce new facility development costs and to correct system inefficiencies.

The Conservation Planning Requirements requires consideration of a set of recommended measures. The minimum conservation plan required by the Conservation Planning Requirements includes collecting data according to the requirements for that size of system, a demand forecast using the methodology required of that size of system, and a conservation program that includes the system's conservation objectives (the level of reduction in use, reduction of peak use, etc.), an evaluation of the conservation measures suggested for that size of water system, a description of the measures chosen and how they will be implemented, an implementation schedule, a budget, and a description of how each measure will be monitored for success. In addition, a conservation plan may include additional measures not identified in the Conservation Planning Requirements. This Handbook contains a description of some additional measures and other aspects of water conservation planning.

Relation of This Handbook to Existing and Future Conservation Planning

The Conservation Planning Requirements were developed, in part, to fulfill implementation of the Water Use Efficiency Act of 1989. The Act requires preparation of water conservation plans as an element in water system plans (RCW 43.20.230 (1)). These rules and regulations provide for the consideration of conservation as an alternative means to meet increased demand (WAC 246-290-065 (5)).

Required water conservation is based on numerous provisions in existing water resource statutes mandating conservation. Prominent among these are RCW 43.27A.090, RCW chapter 90.54, RCW 90.03.005, RCW 90.03.400, RCW 90.44.110, RCW 90.54.020, and Chapter 173-59 WAC.

Rules may eventually be adopted to define the requirements of water conservation planning. Rules were not adopted earlier in order to allow the Conservation Planning Requirements to be circulated, reviewed and tested.

To further assure consistency among the agencies, the Department of Ecology and the Department of Health have agreed that Health will approve public water system conservation plans when that plan is part of an individual public water system plan or Coordinated Water System Plan. The same conservation plan can be used for a water right application.

Standards and procedures for preparation and review of water conservation plans will continue to change in response to changes in water resource management in Washington.

Why Conservation Planning is Important Now

Washington faces periodic and increasingly frequent water shortages in a number of areas. While some values of water are complementary, such as fish habitat and aesthetic enjoyment, other water uses compete: water cannot be used for drinking and for fish habitat at the same time. As the population grows, the same finite water resource is going to have to go farther in order to meet our expanding demands.

How Public Water Systems and Their Customers Benefit from Water Conservation

* Conservation often represents the least costly source of water for the future needs of the public water system.

Water conservation often makes sense as a cost efficient alternative to construction, maintenance, and operation of treatment plants and delivery systems for new water sources. The Federal Safe Drinking Water Act raises the cost of water treatment which will increase the cost of developing new treatment plants and operating existing plants.

* Reducing water flow through sewer systems can increase the life of sewage treatment plants

Rising sewer treatment construction, maintenance, and operation costs can be reduced through water conservation.

* Water conservation illustrates the water system's commitment to reducing customer's bills and to protecting the environment.

Customers respond positively to water conservation if they understand that the water system is pursuing conservation to achieve these benefits.

* Reducing water use will reduce customers sewer bills

Since sewer rates are often based on the amount of water that flows through a residence or commercial building, reducing the use of water will save water system customers money on their sewer bills.

* Reducing water use will reduce the energy costs to the water system.

Decreased demand will result in decreased pumping of water.

* Saving water today provides benefits now which continue into the future.

These benefits include improvement in wildlife and fisheries habitat, an increase in the aesthetic and recreation value of streams and rivers, and protection of water sources for meeting future demand.

* Reducing the amount of water used reduces impacts on water quality.

Reducing the amount of water diverted for municipal and industrial use can increase water quality. Conservation results in less wastewater needing treatment. This reduction in wastewater volume reduces the chance of treatment system overloads which cause wastewater to be released into rivers and lakes. Furthermore, reduced diversion helps to maintain critical instream flows and, thereby, maintains instream water quality.

Who Will Need to Create Conservation Plans

The Water Use Efficiency Act of 1989 (RCW 43.20.230 (1)) provides that water conservation plans be included in water system plans required under statute (RCW 43.20.050 and WAC 246-290-100).

Under the provisions of the Conservation Planning Requirements, all water right permits and petitions to reserve future water rights will require a water conservation plan (RCW 90.03.055; RCW 90.03.400; RCW 90.54.020 (2); RCW 90.54.020 (6); RCW 90.54.180; and RCW 43.20.230).

The specific requirements for a conservation plan under the provisions of the Conservation Planning Requirements will depend on the size of the system.

Terms Used in Water Conservation

A number of terms related to water conservation have specific meanings as used in this Handbook.

Conservation--a reduction in the amount of water necessary to carry out a beneficial use without a reduction in the value of the good or service the water provides. (The difference between long term conservation and short term conservation is defined below.)

Curtailment--a reduction in water use accompanied by a reduction in a good, service, or value associated with the use or presence of water. Curtailment measures are usually imposed only under drought or other supply shortage conditions and are removed when water supply has returned to normal.

Conservation (or Curtailment) Measure--a specific action resulting in conservation or curtailment of water use.

Conservation (or Curtailment) Plan--a collection of actions and a plan for implementing and supporting them.

Efficiency--the least amount of waste possible in the delivery and use of water.

Supply side conservation--an increase in the efficient delivery and tracking of water use. Conservation measures that improve the efficiency of delivery and tracking are the responsibility of the public water system. Supply side measures are referred to as internal measures in this Handbook.

Demand side conservation--a reduction in the amount of water used by customers through measures to increase the efficiency of customer's water use and to encourage voluntary reductions. These measures require shared responsibility between the public water system and the customer. Demand side measures are referred to as external measures in this Handbook.

Short term conservation--measures used in quick response to a drought or other supply shortage. Also referred to as curtailment measures.

Long term conservation--measures used to permanently reduce the consumption of water in order to avoid new source development or to create a supply for future growth. Long term conservation entails investments in technology which take time to implement.

Retrofit--an alteration in an existing water using fixture so that it uses less water than it was designed to use.

Ultra Low Flow--ultra low flow is a term used to describe toilets that use 1.6 gallons or less per flush. Ultra low flow toilets should not be confused with low flow toilets which typically use 3.5 gallons or less per flush.

CHAPTER 2: WATER CONSERVATION ACTIVITIES

A water conservation plan is composed of water conservation measures that the public water system implements in order to reduce water demand. These activities need to be adjusted to suit the needs of the public water systems and the customers they serve. For example, a water system that serves primarily single family homes will tailor their programs to suit the needs of those customers. This chapter provides information about different conservation activities, how to select conservation measures and how to monitor and evaluate the success of the conservation measures chosen.

Descriptions of Conservation Measures

The conservation measures listed below, and described subsequently, are divided into four categories: Public Education, Technical Assistance, System Measures, and Incentives/Other Measures. Some of these measures are activities that are undertaken by the water system, such as leak detection and repair. Other measures, such as the replacement of fixtures, will be developed by the water system but rely directly on the involvement of the public. Public education and Incentive measures require the public to take action to reduce their water use. Some measures are used to inform the public about other measures and create public awareness about water conservation. For example, residential water audits can include the installation of water saving devices, which will result in reduced demand, in addition to presenting customers with information on other conservation measures.

A balanced water conservation plan will have a mixture of Public Education, Technical Assistance, System Measures, and Incentives/Other Measures.

In the descriptions of specific measures which follow, some measures are cross referenced to show the impacts that they have on each other. Most of the measures listed here are from the Guidelines and Requirements for Public Water Systems Regarding Water Use Reporting, Demand Forecasting Methodology, and Conservation Programs. The remaining measures were based on successful conservation activities from throughout the United States.

For additional information on the examples of conservation measures listed here, please refer to the contact person listed. Additional examples of successful incentive measures from California are listed in Appendix B.

Conservation measures should be chosen based on how well the measure fits the water system's needs and whether it is cost effective. Following these descriptions is

a set of tables highlighting attributes of these measures to aid in the selection of measures to fit the system.

Measures also need to be selected to complement each other, for example, public education will need to correspond to retrofit programs so that the public knows how to obtain the retrofit devices and install them. Appendix A contains case studies of conservation plans in Washington to illustrate how measures are combined to form a conservation plan.

Measures Described in this Section

Public Education

1. School Outreach
2. Speakers Bureau
3. Program Promotion (Required)
4. Theme Shows and Fairs

Technical Assistance

5. Purveyor Assistance
6. Customer Assistance
7. Technical Studies
8. Bill Showing Consumption History

System Measures

9. Source Meters (required if requesting water rights)
10. Service Meters
11. Unaccounted Water/Leak Detection

Incentives/Other Measures

12. Single-family/ Multi-family Kits
13. Nurseries/Agriculture
14. Landscape Management/Playfields - Xeriscaping
15. Conservation Pricing
16. Utility Financed Retrofit
17. Seasonal Demand Management
18. Recycling/Reuse
19. Incentives to Promote Efficiency in New Construction
20. Audits of Residential Water Use
21. Audits of Commercial and Industrial Customer's Water Use
22. Employee Outreach
23. Adult Education

Public Education

1. School Outreach

School outreach measures increase awareness of local water resources and encourage water conservation practices by children. Activities include school presentations, preparation of new curriculum material, distribution of new and existing materials, and tours of water utility facilities. The American Water Works Association, the State of California's Water Resources Department, and several Washington water systems have already prepared a range of materials which can be made available at nominal cost for distribution through schools.

Example: The Seattle Water Department has developed elementary school materials and teacher's guides. The locally produced children's workbooks use the names and pictures of Seattle landmarks to clearly show that water conservation is important here. A newsletter, Water Primer, keeps educators up to date on how to add water conservation to the curriculum.

Contact: Mike Mercer, of the Community Relations Office, can provide further information about the Seattle Water Department's education measures at (206) 386-9762.

Second Example: The Water Conservation Coalition of Puget Sound has a Youth Education Committee that develops materials for youth education and participates in youth education events.

Contact: Mike Mercer (number above) is chair of the Youth Education Committee.

2. Speakers Bureau

By actively seeking speaking opportunities and making speakers available to a wide cross-section of service, community, and other groups, the public water system can educate adults about water conservation. Speakers should be provided with audio and visual aids for presentations.

Example: The Seattle Water Department has developed a speakers bureau that increases public awareness through presentations to community groups, homeowner's associations and other groups.

Contact: Mike Mercer, of the Community Relations Office, can provide details about the Seattle Water Department's education measures at (206) 386-9762.

3. Program Promotion

Public water systems may find it necessary to promote the general concept of water conservation and the reasons to pursue water conservation to their customers first before promoting individual conservation measures. The water system can publicize the need for water conservation through television and radio public service announcements, news articles, and utility bill inserts. Customers need to know why conservation is important in their area. For example, customers need to know that conservation is being pursued in order to reduce the strain on the system incurred by peak season use or to avoid a potential shortage during the peak season. Informing customers that by pursuing conservation activities that will result in permanent reductions in water use, such as converting lawns to low water landscapes or changing from inefficient plumbing fixtures to efficient ones, can save them additional costs, in the form of higher rates, incurred from obtaining new supplies.

Furthermore, "selling" the idea and advantages of water conservation to customers, is often overlooked by water systems. Informing water users of the savings they can realize on their water, sewer, and electric bills is a great incentive. Individuals often will not invest in conservation unless they can realize a return on their investment in a brief period of time. Fortunately, most conservation activities do pay for themselves quickly. For example, a very water efficient showerhead, retailing for about twenty dollars, will pay for itself in water and energy costs in about six months. This rate of return is equal to a simple annual return of 200%, which is significantly greater than the rates of return of traditional investments. Offering a rebate for customers who purchase such showerheads coupled with information on the savings resulting from the installation of the showerhead is a very effective means of promotion.

Program promotion can be a part of each conservation measure but pursuing a "package" approach, such as developing a system of promoting specific conservation measures during different seasons or distributing general conservation tips regularly, will make the issue of water conservation stand out in customers' minds. The focus of a "package" approach to program promotion could be to promote landscape water conservation in the summer and toilet rebate programs in the winter.

Example: Cape San Juan Water District, on San Juan Island, uses signs posted at the entrance of the community and on the community center building to remind residents to conserve water in the high use summer months. A bimonthly newsletter, mailed with the water bills, always has at least one conservation topic included. A small (4" by 6") water conservation poster is provided with the suggestion that it be posted in the bathroom visible to both family and guests.

Contact: Elizabeth Plunkett, President of the Board of Commissioners of the Cape San Juan Water District, can provide more information about program promotion efforts of the Cape San Juan Water District at (206) 378-5223. The District is very small with only 95 service connections, but because the district relies on one well, conservation is imperative. Ms. Plunkett also conducts workshops on the operation of small water systems.

Second Example: The Water Conservation Coalition of Puget Sound is a group of Puget Sound area water systems that has decided to work together on promotion of water conservation activities. By pooling resources, this group is able to make better use of media time to promote common conservation activities.

Contact: Holly Kean, Executive Director of the East King County Regional Water Association, is current chair of the coalition ((206) 455-8366).

4. Theme Shows and Fairs

A variation on the theme of customer assistance and employee outreach is participation by the public water system in theme shows or fairs. The water system may wish to prepare a portable display of water conservation devices and selected written material. These events can be used to promote specific aspects of the system's conservation plan or the plan as a whole. Since a presentation at a theme shows or fair is concentrated into a brief period of time, consideration must be given to whether the water system's whole conservation plan or only selected measures should be featured.

Example: The Federal Way Water Sewer District has created original displays for use at shopping malls and other public buildings.

Contact: Gina Hungerford, Water Conservation Coordinator, (206) 946-5426.

Technical Assistance

5. Purveyor Assistance/Customer Assistance

Water systems have an interest in providing assistance, to the other purveyors of water they supply, in the development and implementation of conservation plans and should provide assistance to customers interested in improving the efficiency of their water use. Larger systems may want hire "specialists" in the areas of installing conservation devices or low water landscape design to assist customers in the field. Another option is to identify local experts, such as Cooperative Extension Agents,

who could be used as references for customers. Possible projects to provide assistance to customers includes creating conservation fact sheets or handbooks for different categories of users, maintaining a phone line to answer water conservation questions, and training neighborhood volunteers or contracting with local non-profit groups to install conservation devices in residences throughout the service area.

Regional coordination of the development and implementation of water conservation plans can greatly increase the effectiveness of water conservation. An excellent example of regional cooperation is the Water Conservation Coalition of Puget Sound. The Coalition is a voluntary group of water system representatives and regulatory agency representatives who are working to develop water conservation programs that apply to the Puget Sound area. By pooling resources, these water systems are able to use the local media more effectively and can purchase materials in bulk for a lower price.

Example: The Seattle Water Department supplies water to a number of other water systems. These systems and other regional water systems have benefitted from the use of conservation materials created by the Seattle Water Department's Conservation Office.

Contact: Staff at the Conservation Office of the Seattle Water Department, (206) 684-5879, can describe the types of information they supply to other purveyors.

6. Customer Assistance

Providing assistance to customers directly helps customers feel that the water system cares about providing quality service while promoting efficiency. Options for customer assistance include having a designated staff person to answer customer inquiries, a hotline with conservation information, and bringing in specialists to offer specific conservation assistance such as a workshop on low water use landscaping.

Example: Tacoma Public Utilities offered a series of workshops on low water use landscaping to customers in conjunction with the city parks department.

Contact: Anna Thurston, Water Conservation Coordinator for Tacoma Public Utilities, (206) 502-8723.

7. Technical Studies

Studies to identify conservation opportunities among all user groups should be designed and conducted by the public water system. Some technical studies might be

necessary before implementing new conservation measures, such as studies on the impacts of rate changes on customer behavior or revenue as a step before the implementation of seasonal pricing. Study objectives would be to collect data and research the applicability of new technology in order to identify and develop specific water conservation measures which would produce observable water savings. Improvements to the delivery and storage system should also be considered for study.

Topics for research could include; redesigning storage systems, more efficient methods of collecting water from the existing source, using evapotranspiration information to improve storage and transport of water, development of a system for using treated effluent that meets state and local regulations, and audits of commercial/industrial customer's water use for each Standard Industrial Classification (SIC) grouping.

Example: See the Simpson Pulp Mill example cited under "Recycling/Reuse". Tacoma Public Utilities is also considering surveying commercial/industrial customers by SIC to assess the amount of water used by different types of commercial/industrial customers and determine prime opportunities for significant water use reduction.

Contact: Anna Thurston, Water Conservation Coordinator for Tacoma Public Utilities, (206) 502-8723.

Second Example: The Seattle Water Department is considering the impacts of using treated waste water from Metro in the locks leading to Lake Union.

Contact: Al Dietemann at the Conservation Office of the Seattle Water Department, (206) 684-5879, can report on the status of their reuse study.

8. Bill Showing Consumption History

The bill format can be changed to show the percentage of increase or decrease in water use compared to the same period in the previous year. This allows customers to track their own conservation progress and allows the utility to monitor reductions and increases in per capita use. This bill format works well with the implementation of seasonal rates and meters.

Example: This bill format, which has been used by electric utilities successfully, is being used by the City of Leavenworth to highlight the impact of their new rate structure and meters.

Contact: Mike Cecka, Leavenworth City Administrator, (509) 548-5275.

9. Source Meters

All of the water sources for the system should be metered so that accurate data on withdrawals can be recorded and reported in accordance with the data collection requirements in the Conservation Planning Requirements. The system should institute a periodic meter testing and repair program.

10. Service Meters

The installation of individual service meters for all water use, including public facilities, is required for consideration by public water systems creating a water conservation plan. All water systems should have master source meters and individual service meters in order to collect accurate water use data for planning. In addition, any system with meters should have a periodic meter testing and repair program. Meters are essential for the implementation of other measures, such as leak detection, showing consumption history on customer's bills, seasonal pricing, customer audits and curtailment.

Example: The City of Leavenworth installed meters on all service connections prior to creation of their conservation plan. The result of meter installation and impending rate restructuring incorporating use figures gathered from the new meters, has been a reduction in water use of over 40% over the same period in prior years.

Contact: Mike Cecka, Leavenworth City Administrator, can provide information on the city's installation of meters (509) 548-5275. Also, see the case study on Leavenworth in Appendix A.

11. Unaccounted for Water/Leak Detection

The amount of water lost through the delivery system should be calculated during regular system audits. A system audit is different from the system evaluation described above. A system audit compares the amount of water taken from a system's source of supply to the amount of water sold. If more water is supplied by the system than is sold by the system, leaks, unmetered uses, and/or meter malfunctions are occurring.

The public water system should conduct a regular and systematic program of finding and repairing leaks in system mains and laterals and a regular program of testing and repairing meters. This includes on-site tests using computer-assisted leak detection equipment on water distribution mains, valves, services, and meters. Leak

detection can be conducted either by a utility crew or by a contracted firm. Source and service meters are necessary for leak detection.

The Washington State Energy Office loans leak detection equipment to qualified water systems. To participate in the program, Greg Ware, Washington State Energy Office, (206) 956-2127.

Example: Summit Water and Supply Company crews have been trained to recognize signs of leaks and incorporate leak detection into their work routine. The amount of unaccounted for water was 10% but with a leak detection program, they have been able to reduce that amount by 3%. Now the system's level of unaccounted for water at 7%.

Contact: Neal Doyle, Manager of the Summit Water and Supply Co., can provide information on their leak detection program (206) 537-7781.

Second Example: Before the use of new computer controlled leak detection equipment, Spokane, the second largest city in the state, could not account for about 35% of the water pumped from the source of supply. In the three years since the purchase of the equipment, a noticeable reduction in unaccounted for water has taken place.

Contact: Frank Triplett of the City of Spokane, can provide information on Spokane's computer correlated leak detection system. Mr. Triplett can be reached at (509) 456-4384.

Incentives/Other Measures

12. Single-Family/Multi-Family Retrofit Kits

Public water systems can distribute kits containing inexpensive, easily installed, water-saving devices to single-family residential homes and the owners and managers of apartment buildings and condominiums. Devices in the kits can include:

--Toilet dams, bags or bottles that displace water in the toilet tank to reduce the amount of water used per flush,

--Flushing devices for use on standard gravity-flush toilets that give the customer the option of a low water consumption flush,

--Toilet tank leak detection dye tablets,

--Showerhead flow restrictors or low flow showerheads that reduce the amount of water that flows through the showerhead each minute,

--Faucet aerators that mix air into the flow of water thereby directing and decreasing the flow,

--And water conservation literature.

Because of their very low cost, these kits can be purchased by the public water system and distributed to the public for free.

Distribution can be aggressive, for example water system staff could go door-to-door with the products and offer to install them, or, where the need for conservation is less urgent, they can be made available for pick up at distribution points or installed for a fee. Mass mailings of kits or offering kits on request are other ways to distribute retrofit kits. The Arizona Department of Water Resources has developed a Water Conservation Alternatives Inventory in which successful retrofit programs are described, which can aid in the selection of means to distribute retrofit devices.

Re-collecting unwanted kits can cut costs if the kits are purchased by the utility for free distribution. It must also be noted that all customers may not install all of the devices nor will all of the devices be retained over the long term.

Retrofit products need to be selected carefully. Poorly made and poorly designed products will not remain in use for long, even if the water user received them at no cost. Devices that alter existing fixtures, such as toilet dams and shower head restrictors, need to be tested for reliability and impact on service. In order to avoid duplicating testing, ask the manufacturer for the names of other water systems that have used their product and call those water systems to find out how the product is working or order the Water Use Efficient Technologies for the Urban/Residential Sector by the Rocky Mountain Institute. This reference guide presents an overview of different fixtures available for retrofit kits (see BIBLIOGRAPHY for ordering information).

Example: Snohomish Public Utility District has a program of giving away faucet aerators and low flow shower heads at local events and at customer request. These devices also benefit the conservation of electricity because they reduce hot water use.

Contact: Michael Little, Conservation Program Analyst for the Snohomish County PUD #1, can provide information on the aerator and showerhead give away program (206) 347-1737.

Second Example: The community of Oak Park, California, coordinated with the California Department of Water Resources, their sewer district and water purveyor to conduct a door-to-door retrofit device installation program. All 753 households in the community were contacted and 667 were retrofitted with toilet dams and showerhead flow restrictors. Follow up studies of the area two years after the project revealed that, although customers removed some of the retrofit devices, over half of the toilets and showerheads in the community were still retrofitted.

Contact: The California Department of Water Resources Southern District produced the follow up study, 22 Months Later, The Oak Park Retrofit Program, Still a Success. The study documents customer reaction to the retrofit devices and illustrates the per capita water consumption before and after the program. To order the publication, call the Southern District at (213) 620-4096 or write them at 849 South Broadway, Suite 500, Los Angeles, California 90055.

Third Example: The Seattle Water Department conducted a multi-family housing retrofit program to install low flow showerheads and aerators and repair toilet leaks. Residents were surveyed to gauge their response to the devices. The results of the pilot study showed the program to have been cost effective for both the apartment owner and the Seattle Water Department.

Contact: Suzan Hill at the Seattle Water Department information on the multi-family retrofit program ((206) 684-4150).

13. Nurseries/Agriculture

Public water systems could require or encourage the application of current technology to water use practices of large urban irrigation operations such as nurseries and parks. Moisture sensors, flow timers, low volume sprinklers, drip irrigation, weather monitoring, and other practices to increase irrigation efficiency could be installed. The use of treated effluent for municipal parks and for golf courses is also a major potential water conservation opportunity (see Recycling/Reuse). Technical studies can be done to illustrate the potential savings.

Example: The City of Redmond's Park Department is using evapotranspiration information from the city's parks to determine when and how much to water the parks. The computer operated system uses information from the city's own weather station and information on the rates at which the sprinklers in the parks dispense water to calculate the duration and frequency of watering. The computer system is capable of turning electrical park fixtures on and off as well. With increasing water rates in Redmond, the system will pay for itself in 3-4 years.

Contact: Greg Byszeski of the City of Redmond's Park Department can provide information about the computer controlled watering system (206) 556-2300.

14. Landscape Management/Playfields - Xeriscaping

Outdoor watering is the largest cause of increased water use during the summer. Low water use landscaping, also known as xeriscaping, can significantly reduce peak use. In addition to saving customers money on their water bills, low water landscaping reduces maintenance, fertilizer and pesticide costs. Studies in California have shown that half of the water used outdoors can saved through the implementation of low water landscaping measures, as described below. (See Appendix D for a list of resources)

Low water use landscaping consists of seven basic principles:

1. **Soil Improvement**--Adding organic matter to the soil will allow the soil to retain more water and will also provide the plant with needed nutrients. Organic material should be worked into the soil to create a crumbly texture.

2. **Appropriate Use of Turfgrass**--Lawns are largest water user, compared to other landscaping plants. Choosing the location and size of the lawn, the appropriate grass species for the area, the proper watering, and proper maintenance programs are keys to a low water use lawn. Smaller, rounded shape plots of lawn on flat areas are easiest to water efficiently.

3. **Efficient Irrigation**--There are a variety of irrigation technologies to choose from: drip, timed sprinklers, un-timed sprinklers, and hand watering. Efficiency in any irrigation system is attained by keeping the system in good working order, adjusting the sprinkler heads or drip emitters so that water is applied only to the landscape (not the driveway), and applying water only as plants need it.

4. **Use of Mulches**--Mulches reduce the amount of moisture that evaporates from bare ground. Organic mulches include wood chips, bark, straw, grass clippings, peat moss, pine needles and seed and nut hulls. Inorganic mulches include rock, gravel, decomposed granite, brick chips and coarse sand. Man-made mulches are also available but be careful to use only those that let water and air pass through. Mulches should be spread a few inches thick around the base of shrubs and trees or anywhere bare soil is exposed. Ground cover plants can be used in place of mulch.

5. **Selection of Low Water Use Plants**--Plants should thrive in the regional environment: the high and low temperatures, soil types, available sunlight, humidity, and natural precipitation. Plants native to the region or from other geographic areas with similar climates are the best choice. It is important to note that some low water use plants may have certain needs, such as shade, and placing these plants in areas where these needs aren't met can lead to increased water use.

6. **Planning and Design**--As a rule of thumb, plants with similar water needs should be grouped together in order to design an irrigation system that can efficiently provide different amounts of water to each grouping. Landscape design should also consider the needs of the plants, so that shade and sun are available for different plants.

7. **Appropriate Maintenance**--Many of the lower water use varieties of grass should be allowed to grow taller than traditional grass. Fertilization of lawns and plants should be done infrequently and primarily during the growing season. Remove weeds because weeds require a great deal of water and compete with other plants. Correct pruning to remove dead or diseased growth and to promote the plants natural shape may reduce the plants water demands.

Water users can be encouraged to pursue low water use landscaping through the following conservation measures:

1. Providing information to the public on the potential savings and water quality benefits of low water use landscaping, how to reduce lawn watering, and how to select low water plants and ground covers for distribution in the form of bill inserts, booklets, seminars, door-to-door contact, etc.

2. Providing technical assistance to interested residents, commercial landscapers, and nurseries on how to improve the efficiency of their water use.

3. Requiring a reduction in turf area for new development or the installation of efficient irrigation systems. County or city landscaping codes can be used to encourage these practices.

4. Offering connection charge discounts to the builders of new homes that have installed low water using landscapes (as described under "Incentives to Promote Efficiency in New Construction").

5. Sponsoring a demonstration garden at a public or private building. The costs of the garden can be reduced if the plant materials, garden designs and garden space are donated in exchange for advertisement space or some other incentive.
6. Developing a plant list with the help of county extension agents, master gardeners, botanists, native plant organizations and nursery owners (to insure availability of plants). The list can be distributed to customers by mail or can be available at nurseries. The water system may want to develop an incentive to both the nurseries for providing the plants and to the customers to encourage the purchasing of low water using plants.

7. Offering an incentive, such as a rebate, for customers to remove part of their lawn and replace it with low water using plants and ground cover. Incentives for converting regular landscapes to low water landscapes have been used in California. See Appendix B for more details.

8. Developing an award program for the creators of residential and commercial low water landscapes. Awards for the most attractive landscape, most water conserving landscape, etc., can be presented during a public event with media coverage.

9. Working with the local land use/planning body to create low water use landscaping guidelines or ordinances.

The California Department of Water Resources has prepared a variety of materials on low water landscaping, including descriptions of specific measures and a model state-wide low water landscaping ordinance. For information on the materials available from the California Department of Water Resources, contact the Water Conservation Office, 1416 9th Street, room 804, Sacramento, CA 95814.

Example: North Marin Water District has a number of conservation measures in the area of outdoor water conservation including a "Cash for Grass" rebate, rebates for developers who install low water landscapes, and a booklet and videotape on low water landscaping which targets new and existing homeowners. The booklet and videotape are available at video stores, hardware stores, and garden shops.

Contact: North Marin Water District in North Marin County, California, also has produced a variety of information on low water landscaping. Contact John Olaf Nelson, General Manager of the North Marin Water District, PO Box 146, Novato CA 94948.

15. Conservation Pricing

The use of different rate design techniques can provide an economic incentive to conserve water. In comparison to other conservation measures, changing the rate structure can be an effective and inexpensive conservation alternative. There are a variety of ways to change rates including seasonal surcharges, inverted block rates, goal billing and frequent billing.

Seasonal surcharges increase the unit price of water during the high use period. Seasonal surcharges can be applied to all customers or to those whose seasonal use is extremely excessive. Seasonal prices can be applied to any rate structure, including inverted rates.

Inverted block rates means charging an increased amount for increasing increments of water used. Inverted block rates provide strong incentives for conservation and can be applied seasonally or year round.

Goal billing is relatively new concept that involves offering an incentive to customers who reduce their water use by some amount determined by the water system. The incentive can be a lower water rate or a rebate at the end of the year.

During the periods of high water demand, water systems may wish to bill customers for water more frequently. Receiving bills frequently will focus customer attention on water costs and water conservation.

Meters are important to this type of use based rate setting. Meter information must also be collected regularly in order the monitor the effectiveness of the rate change. See the Bibliography for references on rate setting.

Example: The Seattle Water Department is using a seasonal rate applied to customers' bills during the peak use season from June to August. The seasonal rate can be increased to reflect the marginal cost of the next source of supply needed to meet future peak season demands.

Contact: Al Dietemann, Technical Analyst for the Conservation Office, can provide additional information, (206) 684-5879.

16. Utility Financed Retrofit

The retrofit kit programs described above are usually composed of relatively inexpensive modifications to existing water using devices. Another option is the

replacement of inefficient fixtures with more efficient ones. To date, replacement programs have focused on replacing more costly items, such as toilets.

Plumbing fixtures and fittings used in new construction or in remodelling projects where plumbing fixtures are removed will be required to meet new water use consumption standards that become effective July 1, 1993. Fixtures and fittings that do not meet these new water use standards are prohibited from sale, distribution, offer of sale, importation, installation and approval for installation.

Existing fixtures can be targeted for replacement if an incentive to change exists. Rebate programs require more effort and money than other measures but the results are long lasting and the water savings can be great.

Installation of water efficient toilets in existing residences and commercial/industrial facilities can be promoted by the public water system through one of the following programs:

a. Providing fixtures at no cost;

   Providing fixtures at no cost will encourage the greatest number of customers to participate. This measure is especially feasible from the utility perspective when the cost of new water or wastewater treatment facilities is very high and when very high levels of participation are required, as, for example, when the sewage treatment plant is chronically overloaded. The public water system can negotiate with manufacturers and distributors of plumbing fixtures to get the fixtures at lower than retail price. The water system could also offer free or low cost installation.

b. Offering a rebate to customers who purchase efficient fixtures;

   Offering a rebate can encourage a great number of customers to participate, especially if the customer will realize a substantial savings on monthly water bills. The amount of the rebate will depend on the cost of the efficient fixtures compared to conventional fixture prices, the amount of money the water system has available for funding, the value of the saved water to the utility, and the number of replacements desired over the life of the rebate program. A rebate figure is usually based on the difference between the cost of efficient fixtures and inefficient fixtures and then adjusted to obtain the desired rate of customer participation. The savings in monthly bills that the customer can realize from switching their fixtures will influence the rebate. The cost of installation is sometimes added to the rebate as an added incentive.

c. Arranging for suppliers to provide fixtures to the customers at cost;

   If promoted properly, arranging for plumbing fixture distributors to supply efficient toilet fixtures at cost will entice some customers to switch. Contracting with local plumbers to supply low cost installation is also a good idea. More customers will switch their plumbing fixtures if efficient fixtures are given away or a rebate is offered.

d. Financing customers' purchases of efficient plumbing fixtures through the use of zero-interest or low-interest loans.

   Offering financing to customers will appeal to those customers who had planned to switch their fixtures already or those who will realize such a great decrease in water and sewer bills that the initial fixture cost and interest cost (if any) will be recovered quickly.

Adding a means of collecting the old fixtures to any of the utility financed programs is advisable to keep inefficient fixtures from being returned to use. Water system financed pick up of old fixtures and/or a recycling program for the old fixtures would be ideal. Some water districts in California have proposed to recycle the old toilets into building material for an ocean reef or asphalt paving!

Any of the above programs will require actions by the public water system as described below:

Securing Financing for the Measure

Article VIII, section 7 of the State Constitution had prohibited any county, city, town, or other municipal corporation or political subdivision of the state from giving or loaning money, credit or property to any private individual or organization. This section had prevented public water systems from pursuing rebate programs. But Senate Joint Resolution 8210, approved by Washington voters in November of 1989, amended the State Constitution to permit water systems to use money or credit from operating revenues to finance the acquisition and installation of water conserving equipment or equipment improvements.

Certification of Plumbing Fixtures

Public water systems pursuing a rebate or financing program may wish to certify that fixtures purchased by or for customers meet the new water use standards set by the 1989 Water Use Efficiency Act. The State Building Code Council, the governmental body implementing the 1989 Act, has a list available. To obtain the list contact David Scott, State Building Code Council, at (206) 586-3423.

Example: Snohomish County Public Utility District has a ultra low flow toilet rebate program for the Lake Roesiger LUD area. Mandatory water conservation is required for LUD customers, primarily to preserve the water quality of the lake from degradation by overloaded septic systems. A 150 dollar rebate for ultra low flow toilets is offered for each 1.6 gallon toilet purchased. Lake residents are also given low flow showerheads and faucet aerators by the PUD.

Contact: Michael Little, Conservation Program Analyst for the Snohomish County PUD #1, can provide information on the water heater rebate program and pilot toilet rebate ((206) 347-1737).

17. Seasonal Demand Management

The peaking of demand for water in the summer causes stress for many water systems. This demand can be curtailed through the use of targeted conservation measures. This may include use of seasonal rate structures, distributing lawn watering calendars, promoting public awareness on ways to curb peak day water demand, etc. This measure may be combined with program promotion if materials are distributed.

18. Recycling/Reuse

Recycling is the use of the same water for the same purpose, for example in an industrial cooling process. Reuse refers to the use of water that has been used and treated and used again. Public water systems should examine opportunities for water reuse and recycling as an approach to reducing water demands. Potential uses include:

a. Recycling water for manufacturing processes, industrial cooling, and power plant cooling.

b. On-site wastewater treatment and recycling of effluent for non-potable uses in commercial buildings.

c. Reuse of treated municipal effluent for municipal irrigation.

Treated effluent has been most commonly used for the irrigation of non-food crops or application to land as a form of tertiary treatment. The use of treated effluent for other types of irrigation will depend on the amount of contact humans will have with the land and the level of treatment available.

The benefits of using treated effluent include avoiding the problems associated with direct discharge of effluent to rivers and streams, such as algae blooms and oxygen depletion. Soil acts as a purifier of the water and the soil itself can benefit from the added nutrients. Fertilizer costs may be reduced through the use of treated effluent.

Public water systems interested in developing projects using treated effluent should contact both the Department of Ecology's Water Quality program and the Department of Health. Both Ecology and Department of Health will have to evaluate the site and an engineering study of the proposed effluent reuse project prior to approval. The use of treated effluent will require a permit from Ecology and a potential change in the sewage treatment plant's permit. Ecology's regional water quality office for the area in which the potential project would be located should be contacted for further information.

Requests to use effluent will be subject to conditions prescribed by the director of the Department of Health (WAC 248-92-090). The Department of Health representative for treated effluent projects is George Schlender (509) 456-2490. Projects that would use treated effluent for other than land application will be considered on a case by case basis by the Department of Health.

Example: Simpson Kraft Mill in Tacoma is working with Tacoma Public Utilities to study the possible use of treated municipal effluent within the mill. The potential savings in water use are 6-10 million gallons per day.

Contact: Anna Thurston, Water Conservation Coordinator for Tacoma Public Utilities, can provide information on this program.

Second Example: The Orange County Water District, in Orange County, California, has a goal of reclaiming 100 million gallons of water each day for a variety of major uses including groundwater recharge, protection against seawater intrusion, and irrigation of greenbelts. A separate piping system is used to convey the treated water to existing irrigated areas within a five mile radius of the treatment facility. Reclaimed water used for groundwater recharge is treated to drinking water standards. The Irvine Ranch Water District, also in Orange County, uses reclaimed water for irrigation of greenbelts, parks, golf courses and for flushing toilets in high rise office buildings with dual plumbing systems.

Contact: Katie Coates, Information Officer for the Orange County Water District, can provide information on the District's program to use reclaimed water ((714) 963-5661). Joyce Wegner-Gwidt or Pamela Brigandi with the Irvine Ranch Water District can provide general information about the reclaimed water program and can provide the names and numbers of technical staff ((714) 476-7500).

19. Incentives to Promote Efficiency in New Construction

In contrast to adopting measures to encourage the retrofit of existing structures, public water systems may want to promote efficiency in new construction. Such measures can either be regulatory or can depend on incentives.

Installing water efficient fixtures and low water landscapes in new construction at the time of construction is comparable or cheaper in cost than installing conventional products and landscapes. The additional cost, if any, of water efficient fixtures can be offset by the use of smaller supply pipes, water heaters, sewer pipes, and septic leach fields in housing and commercial developments, unless specific size standards have been set by the Department of Health or the county.

To encourage builders to improve the water efficiency of their developments, public water systems can offer a sliding scale hook up fee. With a sliding scale fee, the capacity charge portion of the fee is set in relation to the amount of water each unit will use. The greater the efficiency, the lower the charge. Water users who do not install water efficient fixtures and landscapes can be charged more for their hook up, thus keeping the revenue impact of sliding scale fees neutral. The water system should inspect the units to assure that the efficient fixtures were installed. Public water systems may consider supporting local land use or landscaping ordinances which will encourage efficient water use. For example, an ordinance limiting the size of lawn for new construction or an ordinance requiring better site preparation prior to installing landscaping will reduce residents demand for water while reducing some of the public water system's responsibility for promoting water conservation.

Example: In the service area of the North Marin Water District, in Marin County, California, a developer who installs a low water landscape in a new development that meets criteria set by the water district is eligible for a credit on the hook up fee for the development.

Contact:John Olaf Nelson, General Manager of North Marin Water District, can supply copies of Regulation 15, which details the District's hook-up fee credit conservation measure. Contact Mr. Nelson at North Marin Water District, PO Box 146, Novato CA 94948.

Second Example: The report Water Productivity and Development: Strategies for More Efficient Use: Proceedings of a Meeting of Water Efficiency Professionals, by Kathleen Menke and John Woodwell of the Rocky Mountain Institute, describes a number of conservation measures and also includes case studies of the sliding scale hook up fee measure, complete with contact names and phone numbers.

Contact: the Rocky Mountain Institute, 1739 Snowmass Creek Road, Snowmass, CO 81654-9199, ((303) 927-3851).

20. Audits of Residential Water Use

An audit of water use in residential buildings can assist water users in improving their water use efficiency. Audits are a specialized form of public outreach. Mailings or other means of promotion can be used to inform customers of the opportunity to have their water use analyzed. After analyzing the customer's water use, a trained water system staff person can offer information about different conservation measures that suit the customer's needs. Staff should be trained in how to measure the rate of water flow from plumbing fixtures, how to detect and fix leaks in plumbing fixtures, and how to apply different conservation techniques to different situations.

The water system may consider coordinating service meter check ups with the audit. Audits conducted in the summer should include an assessment of how water is used outside, especially how water is used to irrigate landscapes.

Water audits are offered to customers at no charge. The cost of training staff to conduct the audits is very low compared to the cost of the water saved, making this a cheap and effective measure. Audits can be done on customer request. Alternatively, more aggressive promotion of audits can be pursued, as indicated in the example below.

A public water system may benefit from working with a power utility to offer customers water and energy audits at the same time. Joint projects can reduce the cost of setting up appointments and training staff.

See Appendix E for a suggested outline of a residential audit.

Example: The Pasadena Water and Power Department (PWPD) has established conservation teams to canvass door-to-door in neighborhoods in Pasadena. The teams conduct audits and, at the same time, install low cost conservation devices that reduce water and energy use. This service was provided to all homeowners and multi-family residences of four units or fewer. The "Lite Bill" conservation program consists of six steps:

1. An announcement letter is sent to residents in a neighborhood to describe the audit and the services available.

2. Conservation teams hang flyers on doors to indicate when they will be in the neighborhood to perform audits and install conservation devices.

3. On the day announced, a member of a conservation team rings the doorbell and asks the customer if they would like to have an audit conducted and devices installed.

4. If the resident accepts the conservation team member's offer, the conservation team's mobile unit is radioed and a team performs the audit and installation.

5. A team member returns a few days later to residences which did not receive services. If no one is home, a water conservation kit and mail-in survey are left at the door.

6. If customers already have water saving devices in their home, they are asked to leave the unwanted items at their doors for pickup by the conservation team.

The service is free. The resident receives, and can have installed, two showerheads, a faucet aerator, two toilet dams, and various energy saving devices.

Contact: Pasadena Water and Power Department's Conservation Programs Coordinator, Mariann Long at (818) 405-4018.

21. Audits of Commercial and Industrial Customer's Water Use

The water use habits of commercial and industrial customers may be very different than those of residential customers. Audit staff should be familiar with the water using activities of the commercial or industrial customer before visiting the customer. A survey form sent to the customer before the audit visit can be helpful. Determining how to reduce the commercial and industrial customers' water use requires specialized training. The public water system may want to contract with a consulting or engineering firm to develop suggestions for reducing commercial and industrial water use. Alternatively, public water systems may be able to take advantage of readily available materials on water conservation for specific commercial and industrial water users, such as restaurants and hotels/motels.

Commercial and industrial customers usually spend far more on water and sewer costs than do residential customers. For these water users, conservation a very attractive way to reduce their costs. Working directly with commercial and industrial customers to develop methods of reducing water use and monitoring the reduction in

water use could be coordinated with a technical study of ways to improve water conservation technology.

Example: The Massachusetts Water Resources Authority has produced a brochure entitled Water Conservation Strategies for Industry, Retail Businesses, Schools, Hospitals, Restaurants and Recreational Facilities. This brochure provides helpful information to commercial and industrial customers on how they can determine ways of reducing water use.

Contact: To order the Massachusetts Water Resources Authority brochure call (617) 242-SAVE.

Second Example: Tacoma Public Utilities is developing a commercial and industrial audit measure study. A variety of approaches and devices will be tested. Public buildings, schools and parks will be targeted.

Contact: Anna Thurston, Water Conservation Coordinator for Tacoma Public Utilities, at (206) 502-8723, for further information and updates on this measure.

22. Employee Outreach

Another aspect of customer assistance and program promotion is training all water system employees about water conservation so that they will be prepared to do public outreach. Water system employees meet with the public everyday. Public outreach can be part of their job. Everyone who works for a water system should know about the conservation measures the water system is promoting and should be able to share this information with water users. Training meter readers in outdoor water conservation techniques will allow these employees to share important information with the water users they meet on their routes. Meter readers may also be able to distribute written material.

A specialized form of employee outreach can be used in times of peak use or drought. In critical water shortage periods, a "Water Patrol", composed of water system employees could drive through residential areas looking for wasteful water use practices. The Water Patrol person could either call or approach wasteful water users to inform them of ways they could use water more efficiently. In the first stages of a curtailment period, the Water Patrol could inform water users of the restrictions on water use that might occur as the situation progresses. In later stages of curtailment, the Water Patrol could become the enforcement section of the water system's curtailment plan, informing the water users of fines or the cut off of service if their wasteful practices continue.

Example: Sammamish Plateau Water and Sewer uses brightly colored door hangers to notify customers when meter readers see wasteful outdoor watering practices.

Contact: Jay Regenstrief, Sammamish Plateau Water and Sewer District, (206) 883-9333.

23. Adult Education

Educating adults about the need for water conservation is the goal of the audits, employee outreach, program promotion, theme show/fair presentations, speaker's bureau and customer assistance measures described above. But public water systems may find that the public's interest in water conservation demands more education and involvement. Classes designed for adults are excellent ways to involve the public in water conservation and also train volunteers to help with the implementation of conservation measures.

Example: The Washington State Unversity Cooperative Extension Programs in Clallam and Thurston counties have incorporated water conservation into classes for adults.

Contact: Kit Paulsen, Water Quality Educator for Thurston County, at (206) 754-4326 and Marycile Olexer, Project Associate for Clallam County, at (206) 452-7831.

Selection Criteria for Conservation Measures

A water conservation plan represents a combination of individual conservation measures selected for their ability to respond to the water supply and demand characteristics and the administrative and financial resources of a specific public water system. Just as each public water system is distinct, each water conservation plan must be distinct. The method by which conservation measures are combined to constitute a plan reflects strategic considerations, such as supply and demand patterns.

Strategic Considerations

Strategic considerations emphasize a mix among measures to achieve a balanced plan. Specifically, the plan should include measures affecting supply and demand, measures to be implemented by the water system and by the customer, and measures that impact all categories of customers. In addition, the plan can be targeted to reduce either peak demand or overall demand. Finally, the plan should reflect a

logical sequence among measures. This sequence should reflect both the interaction among measures and the need for the water system to implement measures at a pace consistent with financial and administrative resources and public awareness. For example, some conservation measures require funding which may increase rates, but covering the costs of developing a new source may raise rates much more. Public awareness of water supply problems and the potential for conservation to reduce demand more cheaply than meeting demand through new source development, may allow the water system to obtain the funding they need for a conservation plan through rates. Hence, public education measures should be the first step in the implementation of a conservation plan.

Another example of the importance of the sequence in which conservation measures are implemented is the critical timing of some measures. For example, a low water landscaping program should be introduced to customers during the early Spring, when homeowners and apartment managers begin to think of yard maintenance.

A final consideration for determining the sequence of conservation measures is to consider how these measures influence one another. An audit program would make customers aware of their water use habits in the home. Water system staff conducting the audit might explain the amount of water used by fixtures in the home. Some of these fixtures can be easily modified, such as showerheads and faucets, but compared to modifying a toilet, replacing existing toilets with water efficient models saves much more water. Thus, audits may make a great introduction to a toilet rebate program.

In the following tables, all of the measures described in the previous section are listed and attributes of each measure are listed to aid in selecting these measures on the basis of how they strategically fit into the conservation plan.

These tables include six attributes of the conservation measures not previously discussed.

1) Surveys often reveal a public preference for incentives over regulation. Consequently, the first attribute listed in the tables is whether the measure is suitable for use with an incentive, such as a rebate or discount on fees.

2) Monitoring is essential to judging the effectiveness of the conservation plan. The second column lists suggested methods of monitoring that particular measure.

3) Some measures impact the efficiency of delivering supply while others impact demand for water. The third column lists the impact of each measure.

4) Some measures impact different categories of customers more than others. The fourth column lists which category each measure impacts.

5) The fifth column lists the impact of each measure on overall demand or peak demand.

6) The sixth column lists which measures that need to be considered in order to meet the requirements of the Conservation Planning Requirements set for different sized public water systems.

Public Education	Can economic incentives be used with this measure?	How to monitor this measure?	Will this measure impact water supply (S) or customer demand (D)?	Impact on customer category- C=commercial R=residential I=industrial	Will this measure reduce peak demand (P) or overall demand (O)?
1. School Outreach	N/A	Track number of schools contacted and number of times visited	D	R	P and O
2. Speakers Bureau	N/A	Track number of customers contacted	D	C, R, I	P or O
3. Program Promotion (Required)	Can be used to promote incentives	Track method and amount of materials distributed	D	C, R, I	P or O
4. Theme Shows and Fairs	N/A	Track number of customers contacted	D	C, R, I	P or O

Technical Assistance					
5. Purveyor Assistance	Yes, incentives to purveyors who impiement conservation plans	Track the number of customer calls and the impiementation of purveyor's conservation plans	D	C, R, I	O, possibly P
6. Customer Assistance	Incentives could be offered to get customers to particiate	Track the number of customers assisted	D	C,R,I	O, possibly P
7. Technical Studies	No	Monitor consumption after study results are impiemented	S or D	C, R, I	P or O
8. Bill Showing Consumption History	Yes	Measure decrease in consumption	D=voluntary consumption tracking	C, R, I	O unless used with seasonal rates, then P

System Measures					
9. Source Meters (required if requesting water rights)	N/A	N/A	S	N/A	O
10. Service Meters	No	Measure the percent of customers metered	S=improved leak detection D=consumption tracking	C, R, I	O
11. Unaccounted Water/Leak Detection	No	Measure decrease in supply delivered	S	C, R, I	O

Incentives/Other Measures					
12. Single-family/ Multi-family Kits	Lower water bills from using the kits is an incentive	Monitor decrease in customer use	D	R	O, unless outdoor use conservation devices are included
13. Nurseries/Agriculture	Yes	Monitor decrease in customer use	D	C, I	P
14. Landscape Management/Playfields - Xeriscaping	Yes	Monitor decrease in customer use	D	C, R, I	P

15. Conservation Pricing	Yes, customers who have pursued conservation on their own can be exempt from the seasonal rate	Measure decrease in consumption	D=voluntary reductions in use due to costs	C, R, I	P
16. Utility Financed Retrofit	This measure is an incentive	Monitor decrease in customer use	D	R but can be extended to include C & I	O
17. Seasonal Demand Managment	Yes	Monitor decrease in customer use	D	Primarily R and C	P
18. Recycling/Reuse	Yes	Monitor decrease in customer use	D	I	O
19. Incentives to Promote Efficiency in New Construction	This measure is an incentive	Compare to water use in new construction without incentives	D	C, R, I	O, possibly P if outdoor use is targeted
20. Audits of Residential Water Use	Incentives can be offered to get customers to participate and incentives can be offered to get customer to install the conseration suggestions resulting from the audit	Measure decrease in customer use	D	R	O, possibly P if outdoor use in included in the audit
21. Audits of Commercial and Industrial Customer's Water Use	Yes, same as above	Measure decrease in customer use	D	C, I	O, possibly P if landscaping is included
22. Employee Outreach	N/A	Track number of customers contacted	D	C, R, I	P or O
23. Adult Education	N/A	Track number of students	D	C, R, I	P or O

Data Collection and Analysis

As mentioned earlier in this Handbook, the collection of data and the development of a monitoring and evaluation system should be done concurrently with the planning process. Data on water use and water use practices, as required and described in the Conservation Planning Requirements, is essential to the development of a conservation plan. Collecting this data creates a baseline to which data collected after the conservation plan is implemented can be compared and will also familiarize the water system with the habits of its customers. Water use patterns in the service area need to be researched in order to know how water is used and how much is used. With this information, during the development of the conservation plan, certain water uses can be targeted for conservation.

Monitoring and evaluation of individual conservation measures are activities conducted during and after implementation of the conservation plan. Monitoring consists of collecting data on specific aspects of a conservation measure, such as the number of customers who receive a particular device, in order to track whether the level of implementation for the measure is being achieved. The level of implementation is the level of effort expended to pursue public participation in the conservation measure. This level is based on the administrative and economic considerations of the public water system. Evaluation consists of analyzing the actual water use after the conservation plan has been in place for a period of time, to identify whether the conservation plan is meeting the goals set during the plan development process. Evaluation can identify areas of the conservation plan that need to be changed. Monitoring data may provide some insight into how the conservation plan could be changed. For example, a not so successful outdoor watering measure could be restructured to include some of the characteristics of a more successful toilet rebate program such as changing the means of publicizing the measure and using an incentive to increase customer participation.

The public water system should describe their program to collect data and the monitoring and evaluation systems in their conservation plan. Details on what types of data will be collected, when the data will be collected, the means of collecting the data, and when evaluation of the conservation plan will be conducted should be included in the conservation plan.

Updating System Information

Data collection, like that described in the Conservation Planning Requirements, should begin before beginning to develop a conservation plan. If this same process is repeated after the conservation plan has been implemented, a comparison can be made between the state of the system before and after conservation.

Factors such as population, growth rate, and revenue should be taken into account when an evaluation is conducted. Looking at the changes in population and growth rate will help determine what effect these changes have had on the demand for water. It is important to try to isolate the impacts of water conservation measures from changes caused by growth or population decline by figuring the increase or decrease in water use attributable to growth or population decline alone. One way to account for population and growth factors is to multiply the average water use per connection by the number of new or discontinued connections in each category of customer and add or subtract that amount from the total annual water use during the period under evaluation.

Information on how water is used by customers in certain activities is necessary to the development of conservation measures and is helpful in monitoring and evaluating conservation plans. This information, to be gathered before conservation measures are implemented, should be based on records of the water use practices by customer category (residential, commercial, and industrial) during both low use periods (typically the winter months) and high use periods (the summer months). For example, subtracting the amount of water typically used by residential customers in the winter from the amount used by the same customers in the summer, adjusting for changes in the number of customers served, should provide a figure representing the amount of water used outside in the summer. The amount of water used by a customer during the winter can be used to represent the water used for basic needs.

Monitoring of Conservation Measures

The method of monitoring and evaluating the conservation measures in a conservation plan involves developing reliable data on each measure of the conservation plan. The savings attributable to some delivery measures, such as school outreach, can not be easily monitored. In this case, monitoring must be qualitative, not quantitative. For example, the public water system should try to monitor whether the water conservation information was understood by the children and whether the children took the conservation information home.

Important monitoring data to keep for each conservation measure includes:

1. The number of customers affected by the measure in each customer category, i.e. the number of customers who received a bill insert or heard a radio ad;

2. The amount of conservation literature and/or devices distributed for each measure,

3. The expected amount of savings from each of the distributed conservation devices,

4. The number of customers who actually received conservation devices or responded to offers of assistance from the public water system,

5. The number of customers who actually installed the conservation devices,

6. The average water use in specific activities by each category of customer before the implementation of a conservation measure targeted for that activity and after implementation of the conservation measure,

7. And data on how changes in weather affect the demand for water in particular activities targeted for conservation measures.

With this data, the public water system can track the success of a particular measure. For example, public water system A is implementing a single family retrofit kit program. In A's service area there are 300 connections, 200 of which are single family homes. The retrofit kits are being offered to customers through a bill insert. If a customer sends in the bill insert, they receive a kit in the mail at no cost. Seventy-five bill inserts are returned to public water system A. Each retrofit kit, containing a toilet displacement bag and a faucet aerator, should save five gallons of water per average day use. A mail-in survey accompanied the retrofit kit. The survey asked the customers if both devices were installed and asked the customers how they felt about the devices. Fifty surveys were returned stating that thirty people had installed both devices and ten people installed just the faucet aerator. The average indoor water use for single family homes served by public water system A is 150 gallons a day. Weather is assumed to have had no impact on indoor water use in A's service area.

The monitoring data for A's retrofit kit measure:

1. Out of 300 total customer connections, 200 single family homes were informed about the retrofit kits.

2. Seventy-five customers received retrofit kits and the mail-in survey.

3. If both pieces were installed, the retrofit kit could save five gallons a day. The aerator only is assumed to save a gallon a day.

4. The number of customers who actually received the kits may be only fifty, because only fifty people returned the mail-in survey, which was A's device to gauge how many people received the kit.

5. Thirty people actually installed both devices, ten installed just the aerator.

6. Average single family home indoor water use was 150 gallons a day before the kits were distributed. The amount used after distribution will be figured below.

7. Weather is assumed not to affect this type of water use.

The total water used before implementation of the retrofit kit measure was 200 homes x 150 gallons a day= 30,000 gallons a day. After the kits were distributed, water use for the same homes should be:

(160 non-participating homes x 150 gallons per day)
(30 homes with both devices installed x 145 gallons per day)
+(10 homes with faucet aerator installed x 149 gallons per day)
29,840 gallons per day

The total savings in indoor water use from this one measure is 160 gallons per day.

If more than one conservation measure is designed to target the same type of water use, there may be some difficulty in separating out the saving attributable to each measure. If data is kept on the number of customers affected by each measure, both those directly participating and those not participating, coupled with the use of surveys or some other means of tracking participation, a better estimate of the success of each measure can be obtained.

Evaluation of Conservation Plan

To obtain information on how the public perceives the water conservation program surveys (mail in, phone calls, etc.), asking customers about their perception of the program, and collecting comments from customers when they call the water system are all options for collecting information that will help you evaluate the conservation plan.

With a means of monitoring the conservation measures in place, evaluation of the conservation plan will be easier. The evaluation of the conservation plan should be undertaken periodically to allow "fine-tuning" of the conservation plan.

Evaluation involves looking at the conservation plan as a whole after a period of time, to see if the original goal, created when the plan was created, has been met. Using monitoring data for individual measures, evaluation can lead to adjustments in

the goal or in the individual measures, subject to the economic and administrative constraints of the public water system.

Public water system A is evaluating its conservation plan after five years. In addition to the retrofit kit measure, described above, A also offered technical assistance to commercial customers, visited local schools with water conservation materials for the children to take home, and put up a billboard with the message "Saving water is like money in the bank" with a picture of a turned off faucet on one half and fish swimming in a stream on the other half.

Out of 300 connections, 100 are commercial accounts. Free technical assistance was available on request and all commercial accounts were notified by direct mail. Over the five year period, 20 commercial customers took advantage of the assistance. Assuming that each of these commercial customers used a similar average amount of water before implementation of the assistance program, the technical assistance allowed these twenty accounts to save 20 gallons a day. Previously, each commercial customer used 200 gallons a day.

Direct estimates of savings can not be developed for the school program and the billboard. All of the schools in A's service area were visited and the billboard is prominently placed so that it is assumed that all customers saw it at some time during the five year period.

The original goal of A's conservation plan was to reduce average daily water use by ten gallons for each commercial account and five gallons for each residential account, for a total daily reduction of 2000 gallons a day.

The residential retrofit program, based on monitoring data, was estimated to save a total of 160 gallons per day in an average year. Before the implementation of any conservation measures, residential use was 30,000 gallons a day. To evaluate the success of the conservation plan, A should compare estimated savings to actual water use for each category of customer. Actual average daily indoor residential use for each year are:

Year 1 = 29,840 Year 2 = 29,000
Year 3 = 30,000 (leaks may have increased use)
Year 4 = 29,000 Year 5 = 29,000

The average daily residential use over the five year period was actually 29,368 or only 632 gallons a day less than before the measure was implemented, due to the increased use during the third year.

Before implementation of the commercial account assistance program, 20,000 gallons a day was used on average by commercial customers. After five years with 20 accounts participating, average daily water use was estimated to be 19,600 gallons a day. Actual average daily use after the technical assistance program was 19,800.

The result of this evaluation of A's conservation program shows that the original goals were not met. A has a choice; if budget and staff allows, the promotion of the technical assistance program and/or retrofit kit program can be improved to increase participation or new conservation measures could be implemented. The use of incentives and better conservation devices could also be explored.

Evaluations of real conservation plans will also have to account for seasonal water demands and growth or reductions in the number and type of customer served.

Demand Forecasting

A forecast of demand is required as part of the water right application process and the reservation petition process. The demand forecast figures should reflect anticipated conservation savings even if the conservation plan has not yet been fully implemented. This means that the public water system will have to estimate the savings obtainable. After the conservation plan has been implemented for a while, demand forecast figures may be revised to reflect actual savings.

To estimate the water savings potential of different conservation measures and devices, public water systems can contact the water systems used as examples and case studies in this Handbook or regional water associations and water professional's organizations for sources of information. Two other sources of information on estimates of savings, are the Residential Water Conservation Project Summary Report, prepared by Brown and Caldwell, Consulting Engineers for the United States Department of Housing and Urban Development, Office of Policy Development and Research, June 1984, and the Water Conservation Alternatives Inventory by the Arizona Department of Water Resources, Tucson Active Management Area. This inventory of alternatives provides information on conservation devices, such as expected lifetime, savings per device, and historical use. The inventory covers indoor and outdoor conservation measures. The inventory is available from the Arizona Department of Water Resources, Tucson Active Management Area, 310 South Meyer Ave., Tucson, AZ 85701.

Chapter 3: Conservation Plan Implementation

How to Choose the Order of Implementing Conservation Measures

It is very important that the conservation plan be implemented in a systematic manner. For example, public education in the form of program promotion is necessary before the implementation of a new measure, or group of measures, in order to expose the public to the details of the measures. Some measures should be tried before others. Voluntary measures usually cost less than regulatory measures because of the expenses incurred in the regulation adoption process and in enforcement. The water consumers may respond to voluntary measures (especially if combined with incentives) and save enough water to make regulation unnecessary. Some measures can only be effective if coupled together, such as installing service meters and setting new, use-based rates or distributing toilet retrofit devices and educating the public on how to fix toilet leaks. In the latter example, the amount of water saved per flush from installing a retrofit device could be lost through a leak in the flapper.

Using more than one similar water conservation measure at one time to reduce water use by one category of water user will decrease the efficiency the measures. If more than one measure is used, water users will make a choice between the two measures. For example, if single family residents are offered a both a toilet retrofit program and a toilet rebate program, the retrofit program, even though it saves less water in the long run, will be selected more often than the rebate program. The retrofit program will be seen as easier to participate in. The result will be that amount of saving possible from implementing each measure will be reduced.

The order in which measures are implemented will affect the development of the whole conservation plan: from major decisions such as how many extra staff (if any) will be hired, when they will be hired, the flow of funding and timing of major expenditures, to minor decisions such as when to send the bill inserts to the printers.

Financing Options for the Water System

Publicly owned water systems can dedicate part of their budget to conservation activities, including rebates and financing programs for their customers who purchase water efficient products. Article VIII of the State Constitution, passed by voters in November of 1989 (Senate Joint Resolution 8210) allows publicly owned water systems to "lend credit" to customers and dedicate funds to conservation activities.

If money for water conservation is not available in a water system's budget, outside financing will be necessary. Financing options available to public water

systems for water conservation projects are limited, and of those options, many are only for publicly owned public water systems. Publicly owned public water systems include water districts, public utility districts, cities and towns. Privately owned public water systems include profit making companies (either investor or individually owned) or non-profit associations, mutuals and cooperatives. Privately owned public water systems are not allowed, under the state constitution, to receive public funds, leaving privately owned systems to rely on more expensive means of financing. The Utilities and Transportation Commission (UTC), which regulates privately owned systems, now allows these systems to create a reserve account for capital improvements to the system, if those improvements have been approved by the Department of Health as part of the Water System Plan (RCW 80.28.022).

Commercial loans or traditional municipal bond funding are an option, albeit more costly than some other options. Because the process of applying for a bank loan or issuing bonds can vary greatly from water system to water system, these options will not be covered here.

The Rural Community Assistance Corporation (RCAC) works with residents, local governments, and owners of small water and wastewater systems (both publicly and privately owned) to improve the systems. In order to rehabilitate existing or develop new systems, RCAC can prove technical assistance and training in operations, management, and rate setting, and RCAC can be of assistance in finding funding. RCAC operates a Northwest Office in Lacey, Washington. For further information on their services, contact Laura David at (206) 493-2260.

A resource book written for energy suppliers can provide some helpful information and ideas applicable to funding water conservation. Financing Energy Conservation : What States and Cities Can Do, by Michael Freedburg and Anne Hatfield for the Center for Policy Alternatives, contains good ideas and practical advice for utilities. The book, which came out in 1983, may be available from the Center, (202) 387-6030, if it is not available through the local library.

Local governments may wish to explore the potential opportunities for innovative funding and for encouragement of water conservation provided in the Growth Management Act. For example, density bonuses might be considered for developers who pursue water use efficiency.

The costs of plumbing fixture replacement and rebate programs may also be shared with the wastewater system. The wastewater system may benefit from reduced sewage flows. As an incentive for water users to replace fixtures, a water system may consider adding a charge to water users who do not convert their fixtures.

Grants and loans are available to publicly owned public water systems from both federal and state sources. Please contact the administering agency for further details.

1. Department of Community Development:

The Public Works Trust Fund provides low cost loans for public works improvements to counties, cities, and special purpose districts. A capital improvement plan must be in place and must cover all the applicant's systems eligible for Public Works Trust Fund money. Counties and cities must be levying the optional one quarter of one percent real estate excise tax. Applicants are ranked on based on priorities established by the Department. Money is to be used to repair, reconstruct, replace, rehabilitate, or improve existing domestic water to serve the current population to current standards. The funds can also be used for the replacement of contaminated wells with a new system. Zero interest loans are also available to help with the development or improvement of a capital improvement plan.

Contact: Pete Butkus at (206) 493-2888.

Community Development Block Grants are federal grants administered by the states and available to counties and cities to serve the needs of low and moderate income residents. Non-entitlement cities and counties are eligible. The project must principally benefit low and moderate income residents and have a citizen participation/community development plan. Money can be used to design, construct, or reconstruct domestic water (source and supply) projects. Meter installation and leak detection and repair may be undertaken as part of construction or reconstruction project.

Contact: Charmaine Hays at (206) 586-1243.

Note that grants and loans can be used as leverage for bank loans.

2. Farmer's Home Administration:

The Water and Waste Disposal Loans and Grants program and the Community Facility Loans program are available to public bodies, non-profit corporations, and Indian tribes for construction of water systems including engineering and legal fees. Restrictions apply to applicants.

Contact: Marty Wold, Chief, at (509) 662-4358.

3. U. S. Department of Commerce, Economic Development Administration (EDA):

EDA has two programs through which publicly owned water systems may find funding for water conservation related activities. The main criteria for EDA funding is that proposed projects must generate jobs. Rural areas (less than 25,000 in population) are preferred over urban areas. The Technical Assistance Program funds feasibility projects which may have water conservation benefits, for example, a study

of the design of a water reuse treatment plant. The Public Works Program funds a wider array of projects such as the expansion of a water system to meet the needs of new industry, system improvements including leak detection, replacement and meter installation in public areas, and the development of water reuse treatment facilities to supply water to new industry and development.

Contact: Economic Development Offices around the state serve different counties and can advise publicly owned water systems on how to apply for EDA funding.

King, Kitsap, Pierce, and Snohomish
Central Puget Sound Development District
Contact: William H. Mahan, Executive Director
(206) 623-2744

Clallam and Jefferson
Peninsula Development Association
Contact: Judith St Clair, Executive Director
(206) 457-7793

Stevens, Ferry and Pend Orielle
TRICO Economic Development District
Contact: Donna Marco, Executive Director
(509) 684-4571

Kittitas and Yakima
Kittitas-Yakima Development District
Contact: Edgar Harrell, Executive Director
(509) 575-2932

Grant, Lincoln and Adams

Big Bend Economic Development District
Contact: Rex Eads, Executive Director
(509) 754-2125

Benton and Franklin
Benton-Franklin Governmental Conference
Contact: Donald Morton, Executive Director
(509) 943-9185

Asotin, Whitman, Columbia and Garfield
Palouse Economic Development Council
Contact: Mary McBride, Executive Director
(509) 843-1104

Skamania and Klickatat
Mid-Columbia Economic Development District
Contact: Betty Mills
(503) 296-2266

Counties not covered by an Economic Development Office can call EDA directly and speak to Jay Busch, Economic Development Representative for Washington at (206) 553-4740.

Possibilities for Interaction with Other Public Utilities

Public water systems should consider the advantages of coordinating the conservation of water with the conservation of energy or the reduction of wastewater flows to sewage treatment facilities. By sharing the costs of mutually beneficial conservation measures with energy, wastewater treatment or storm water utilities, the water system can reduce per unit costs of conservation and, thereby, increase the amount of water conserved. Working with another utility expands the water system's access to program promotion opportunities, such as inserting information on toilet retrofit devices in the sewer bill mailings.

Another option for water systems to cut water conservation costs is to team up with other water systems in the area. A group of water systems can use the local media better than individual systems can because a group would be able to purchase larger shares of media coverage and would reduce customer confusion by sending a unified message to all water users.

The Washington State Energy Office recognizes the link between water and energy conservation. The Energy Office has a clearinghouse for distributing conservation information directly to energy users. Recently, the Energy Office has expanded the scope of information it supplies to include water conservation information. These materials can be a great resource for water systems. The Residential Clearinghouse number is 1-800-962-9731.

Administrative Considerations

This Handbook has introduced the elements of conservation planning: the identification of system characteristics, the creation of conservation goals and objectives in response to specific characteristics of the system, possible measures, how to select measures for a plan, and implementation of the plan. None of this can occur, of course, unless the public water system makes a policy decision to support conservation and then commits resources to the development and implementation of a conservation plan.

Smaller public water systems may find that they need assistance in administering their conservation plan. For such systems, it may be cheaper and more effective to contract with a consultant for the creation of their conservation plan instead of hiring and training new staff. The Washington State Association of Water and Wastewater Districts can advise public water systems on how to hire a consultant. The Association can be reached at (206) 524-9270. The Department of Health's Drinking Section has prepared a guide for small water systems on hiring engineers, "How to

Hire an Engineer". This document may provide assistance to systems hiring consultants for the development and implementation of water conservation plans.

Creating a work plan for the administration of the conservation plan will ease the implementation. The work plan should include a list of specific tasks, schedules, and responsibilities. The work plan should be included in the conservation plan.

Because of the range of conservation products on the market, water systems can choose between a variety of devices of different price and water saving capacity. Choosing the highest quality products available within the public water system's budget means that a greater number of devices will be installed and retained. If retrofit or replacement projects are contracted to private companies, the public water system should be careful to check that they are using the most efficient and cost effective devices possible instead of investing in cost cutting intermediary devices.

Public water systems are often reluctant to pursue conservation aggressively for fear that conservation may reduce revenues and raise costs. While this is a justified concern, it should not permanently affect the rate or level of conservation. The manner in which rates are revised in response to conservation depends on the particular condition of each public water system. Where conservation increases net costs to the public water system, rates must be raised. Even where net costs are not increased, rates must rise if conservation is to be successful since the same costs must be carried by fewer units sold. While rates per unit sold may rise, average monthly bills may decline. Water systems need to explain this to their customers. Only in the infrequent situation where a decline in costs resulting from conservation is significant, e.g. reduced purchase of very expensive water from an adjacent water system, might conservation result in a rate decrease. Secondly, rate increases from conservation must be considered in relation not only to current rates but also in relation to future rates without conservation. Conservation may eliminate or delay the need for costly new sources which would otherwise result in even greater rate increases.

The effect of conservation on both rates and revenues is a complex concern that justifies careful consideration and the possible involvement of a rate expert. While larger public water systems may have routine access to rate experts, smaller public water systems may want to obtain outside advice. Under provision of RCW 43.20.230, the Department of Health is directed to provide advice and technical assistance upon request in the development of water conservation plans and model rate setting formulas[1].

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[1] For more information on rate changes see the article "Should You Raise Rates To Pay For Compliance?", in Opflow, a monthly publication of the American Water Works Association, August 1990.

Chapter 4: State Involvement in Water Conservation Planning

Regulation

The review and approval of conservation plans by the Department of Health and the Department of Ecology will be based on compliance with the Conservation Planning Requirements. Health will be the lead in reviewing conservation plans.

The Conservation Planning Requirements will be incorporated in Ecology and Health policy and program documents. They will be subject to routine review and modification jointly by Ecology, Health, and interested parties, including WWUC, as data collected and program results are assessed against the overall objectives. Approval of a water conservation plan is a necessary but not sufficient condition for issuance of a water right permit by Ecology. Ecology must also consider many other factors in addition to the conservation plan. **A water conservation plan in compliance with the Conservation Planning Requirements will be required for approval of water system plans and for issuance of water right permits for public water systems by Ecology.** Approval of a conservation plan will be based upon review of all three components of the conservation plan. These components include water use data collection, demand forecasting, and the conservation program development. Conditions may be attached by Health to a water conservation plan where such a plan is part of a water system plan, and by Ecology to a water right permit where such permit requires an approval of a water conservation plan. These conditions may specify requirements for data collection, demand forecasting, or analysis of measures in a conservation program.

Chapter 5: Summary

In the face of increased demands on water and new directives from Ecology and the Department of Health, public water systems must recognize that water conservation planning is a permanent and increasingly important aspect of water management. Conservation needs to be incorporated into the budget and administrative organization of public water systems. A water conservation plan needs steady funding (especially for education and enforcement), knowledgeable staff with time to commit to the plan, public education and public involvement in the development and implementation of the plan.

Increased population and increased pressure to maintain and enhance water dependant natural systems indicate that water conservation will receive increased public attention in the future. Legislative recognition of this fact is reflected in statues which clearly identify water conservation plan development and implementation as strong elements in state water policy. To meet its responsibility to encourage water conservation provided for in statues, the Department of Ecology and Department of Health have prepared this initial Handbook, which will be continuously revised and updated. The full cooperation of public water systems in the revision of this Handbook is essential. For this reason, we encourage, request and welcome your comments and suggestions regarding revision of this Handbook. A preliminary list of topics to be covered in future editions can be found Appendix F.

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American Water Works Association, Before the Well Runs Dry, vol. 1-A Handbook for Designing a Local Water Conservation Plan, AWWA, Denver, CO, 1984

United States Department of Housing and Urban Development, Office of Policy Development and Research, Residential Water Conservation Project Summary Report, prepared by Brown and Caldwell, Consulting Engineers, June 1984

This report is useful as a source of information for estimates of water savings resulting from conservation measures.

Water Conservation Reference Manual: Urban Conservation Measures, California Department of Water Resources, March 1984

This comprehensive handbook can be obtained through the Department of Water Resources, 1416 Ninth Street, PO Box 942836, Sacramento, CA 942836-0001, phone (916) 445-9248

Menke, Kathleen, and Woodwell, John, Water Productivity and Development: Strategies for More Efficient Use: Proceedings of a Meeting of Water Efficiency Professionals, Rocky Mountain Institute

These proceedings describe a number of conservation measures and also includes case studies of the sliding scale hook up fee measure, complete with contact names and phone numbers. To obtain the document, contact the Rocky Mountain Institute, 1739 Snowmass Creek Road, Snowmass, CO 81654-9199, (303) 927-3851.

System Audits

Jeffs, Charles, et al., Training Guide: Water Audits, An Introduction, National Rural Water Association, 1989

Water Conservation Reference Manual: Urban Conservation Measures, California Department of Water Resources, March 1984, pgs 66-76

See full entry under **General Planning Guidance**.

Rate Restructuring

Raftelis, George, A., "1988 National Water Rate Survey", Journal AWWA, September 1988, pg. 78

This study provides a comparison of rates around the country in 1988 and explains how to develop an effective rate structure for recovering service costs.

"Should You Raise Rates to Pay for Compliance?", Opflow, monthly newsletter of the American Water Works Association, vol. 16 No. 8, August 1990

This article explains how to approach a rate change; how prepare for change, how to inform the public, how to choose a method of increase.

Benefit/Cost Analysis

California Department of Water Resources, WaterPlan software, manuals and updated Service Area Information.

To order call (916) 653-9478

Brown and Caldwell, City of Antioch; Urban Water Management Plan, January 1986

This comprehensive plan serves as a good example of the selection of measures through benefit/cost analysis. This plan also serves as a good format to follow for writing a conservation plan.

Woodwell, John, Supplying Denver with Water Efficiency: An Alternative to Two Forks Dam, Rocky Mountain Institute, February 21, 1989

This paper illustrates how water conservation can offer the greatest benefits at the least costs in addition to being the soundest choice ecologically.

Stokey, Edith, and Zeckhauser, Richard, A Primer for Policy Analysis, first edition, W.W. Norton

This book provides a good discussion on the choice and use of discount rates. This book is also a source for additional references.

Water Efficient Devices

"How to Save Water", Consumer Reports, July 1990, pg. 465

This article includes information on toilets, showerheads, and the monetary savings to the water user if they switch. Also includes material that could be used to answer water user questions on conservation devices.

Arizona Department of Water Resources, Tucson Active Management Area, Water Conservation Alternatives Inventory

This inventory of alternatives provides information on conservation devices, such as expected lifetime, savings per device, and historical use. The inventory covers inside and outside devices. The inventory is available from the Arizona Department of Water Resources.

Ultra Low Flow Toilet Bulletin by WL Corpening and Associates, 2882 Love Creek Rd., Avery CA 95224, (209) 795-1758

The bulletin is updated periodically and includes information on different features of different brands. Cost for the bulletin is $150 for 4 issues (one year).

Water Use Efficient Technologies: A Catalog for the Residential/Light Commercial Sector by the Rocky Mountain Institute, 1739 Snowmass Creek Road, Snowmass CO 81654-9199, (303) 927-3851

This reference guide presents an overview of different technologies available for many types of fixtures. To order call (303) 927-3851 and ask for item number W91-18

Vickers, Amy, "Low-Flow Toilets", Fine Homebuilding, July 1990, pg. 62

Kourik, Robert, "Toilets: The Low-Flush/No-Flush Story", Garbage, January/February 1990, pg. 16

Low Water Landscaping

Ball, Ken, Xeriscape™ Programs for Water Utilities, American Water Works Association, 1990

This book covers the details of planning and operating a xeriscape program. Costs and benefits of xeriscape are described. The book is available through the American Water Works Association, 6666 West Quincy Ave., Denver CO 80235.

Nelson, John Olaf, "Water Conserving Landscapes Show Impressive Savings", Journal AWWA, March 1987, pgs 35-42

This article describes the eight and a half month study undertaken by the North Marin Water District which compared the water, labor, fertilizer, fuel, and herbicide savings of low water landscapes to traditional landscapes.

How to Produce a Lawn Watering Guide, Water conservation Guidebook #4, California Department of Water Resources, January 1987

Water Conservation Reference Manual: Urban Conservation Measures, California Department of Water Resources, March 1984

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Landscape Conservation Guidebook #8, California Department of Water Resources, March 1988

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Organizations:

National Xeriscape Council, Inc., 940 E. Fifty-first St., Austin, TX 78751-2241
National Wildflower Research Center, 2600 FM 973 North, Austin, TX, 78725

Water Reuse

Asano, Takashi, and Mills, Richard, "Planning an Analysis for Water Reuse Projects", Journal AWWA, January 1990, pgs. 38-47

This article outlines the process of planning a reuse project and illustrates the variety of considerations necessary to incorporate into the planning process. Includes a case study of Walnut Valley, CA.

Rebate and Other Incentive Programs

Nelson, John Olaf, Promoting Less Turf with Connection Fee Discounts and Rebates, North Marin Water District, 999 Rush Creek Place, Novato, CA, 94948-0146, (415) 897-4133.

This paper was presented to the AWWA national convention held in Los Angeles, CA, June 21, 1989.

Soltani, Atossa, City of Santa Monica's BAYSAVER Fixture Rebate Program, City of Santa Monica, Environmental Division, 1685 Main Street, Santa Monica, CA

This material was included in the Bay Saver Fixture Rebate Program package sent to City of Santa Monica customers.

Little, Michael, Snohomish County PUD Ultra Low Volume Toilet Rebate Program (DRAFT) description paper dated August 21, 1990, PO Box 1107, Everett, WA 98206 (206) 258-8211.

This paper describes the pilot program as of the date written. Contact the author to check for changes.

Appendix A

Case Studies of Water Conservation in Washington

Water Conservation in Leavenworth, Washington

Leavenworth is a city of approximately 1700 people, located on the east side of Stevens' Pass on State Route 2. The Wenatchee River flows through town and Icicle Creek enters the Wenatchee River one mile south of town. The City supplies water to a service population of approximately 2500 people, approximately two thirds of whom live within city limits.

Currently, the City's water sources are a diversion from Icicle Creek and wells to withdraw water from the Wenatchee River. City water demand had historically caused the Icicle Creek water rights to be violated, although the incidence of water right violations has dramatically declined since 1987, and no violations have occurred since 1989. The city has applied for increased water rights on both the Icicle and the Wenatchee River. The additional water right on Icicle Creek would be interruptible subject to minimum instream flow requirements while the new right sought for the well adjacent to the Wenatchee River would require a conditional exemption from instream flows.

Leavenworth's main industry is tourism. Peak tourist seasons occur from early summer to fall and during the winter holidays.

The Need for Water Conservation

For about the past ten years, water shortages have occurred in Leavenworth in the late summer, when peak demand coincided with minimum flow in Icicle Creek. In an attempt to maintain adequate reservoir levels and, in recent years, to comply with provisions for instream flow, Leavenworth annually imposed a curtailment program. This included the imposition of a odd day/even day watering schedule for different parts of the city.

The City was faced with numerous water system problems: periodically the water level in the City's single reservoir became dangerously low; chlorine contact time was inadequate; the City was unable to identify its largest water users; the condition of the reservoir and its supply pipe were deteriorating; wastage occurred at the reservoir and the water delivery system was failing; there was no alternate source when the turbidity levels on Icicle Creek were too high. Leavenworth has had meters at the

sources of their water withdrawal and at locations where mains enter the City for many years, but the City did not have service meters. When the idea of installing service meters was presented to the community, strong opposition to the idea was expressed.

According to the city's Capital Improvement Plan of 1987, both the maximum day water use per capita and average day water use were well above the comparable averages for small cities in Eastern Washington, even when water use was adjusted to eliminate the considerable effect of tourism on water use. The maximum day water use per capita for the 1984-1987 period, adjusted for tourism, was 1380 gallons; 38% above the 1000 gallons per capita per day average for comparably sized Eastern Washington cities. The annual average daily per capita use figure for Leavenworth, adjusted for tourism, was 460 gallons, compared to 400 gallons per capita per day average for comparable Eastern Washington cities.

Leavenworth's Response

Preliminary discussions between Ecology and the City of Leavenworth regarding the city's request for additional water rights emphasized the need for a water conservation plan. However, as a result of withdrawals in excess of existing water rights, the high per capita use figures and pressure from the State Department of Health, the city recognized the need to install service meters as the first step in developing a conservation plan. Installation of service meters began in the fall of 1988. The meter installation program was funded by the State Department of Health, a community development block grant, a public works trust fund loan and charges for individual commercial meter installation. The total cost of the program was $575,000.

The mere installation of meters appears to have had a major effect on water use in Leavenworth. Summer use in 1988 was 18% less than in comparable years, well before the adoption of rates based on metered water use. At the time the meters were installed, residents were given information on the anticipated adoption of water rates based on the use and information on the benefits of more efficient water use. In the spring of 1990, the water bills included information, based on meter reading, of what the charge would be if the proposed higher rates were in effect.

Rates linking the price of water to the quantity of water used were passed by the Leavenworth City Council in May of 1990. By charging an increasing amount for successive units of residential consumption during the summer months between May and October, the rates provide a strong incentive to conserve during these months. During these months, the new residential base rate for city residents is $19.82 per month for the first 15,000 gallons. For water above 15,000 gallons per month, rates increase by $.69 per 1000 gallons. Senior citizens have an option to purchase 7,500

gallons for $14.63. For the remainder of the year, residential customers are charged a flat fee of 19.82 a month regardless of the quantity of use.

For the months of June, July and August, the months immediately following the adoption of the new rates, water consumption dropped an average of 43% from consumption during the same months in 1989. This is in addition to the previously observed decline of 18%.

This impressive reduction will inevitably level off in time. According to Mike Cecka, City Administrator, some water users overreacted to the new rate structure by letting their lawns dry up. Mr. Cecka suspects that some citizens may believe that they are only allowed to use the amount of water paid for in the base rate and hence are taking actions now to conserve water that they may not pursue in the long run. On the other hand, customers with high use rates this summer may install sprinkler systems which will continue to cut usage next summer.

Water use information resulting from the metering program has allowed Leavenworth to keep track of large water users and identify ways in which these users can reduce their bills. Meter information has led to the discovery of major leaks which wasted thousands of gallons a day. The meter readers look for leaks during their rounds.

A few problems resulted from the meters and new rates but Leavenworth has found ways of resolving these problems. Installing meters was an imposition but most residents accepted the program once the need for meters and the City's program of meter maintenance was explained. A few residents complained of the noise the meters make. A clicking sound can be heard when water is passing through the meter and in some homes this noise travelled along the pipes and could be heard in the house. These meters were replaced by the contractor. Some homes in the city were not connected directly to a service main but were connected to a neighboring house, because the residences were at one time inter-connected. Residents had the choice of paying for a new service hook up at cost of about $750 or working out a means of splitting the water bill between the two houses. Some residents and business owners objected to the new rate structure because they felt it did not distinguish between types of water users.

Other Aspects of Conservation Planning

On July 24, 1990, the City Council approved a water conservation plan and a water curtailment plan. The conservation plan has four objectives:

1. To inform Leavenworth water users of the need to use water efficiently and to suggest means of achieving efficiency.

2. To reduce peak and average water use to the level of metered Eastern Washington cities of comparable population.

3. To encourage residential (single family homes) and commercial (all other users) to increase the efficiency of their indoor water use.

4. To improve supply to the whole service area by allocating conserved water to new customers.

This is an interim plan for use until December of 1991 when new meter data and other factors will allow the design of a new plan. The City will retain a consultant to review the cost efficiency of conservation and system expansion options.

Contact: Mike Cecka, Leavenworth City Administrator, (509) 548-5275.

Water Conservation in Bellevue, Washington

The City of Bellevue is a highly urbanized city located east of Seattle. The City of Bellevue water utility serves about 30,000 accounts. All water for the City is supplied by Seattle's Tolt and Cedar River water sheds. The treated water is provided by Seattle on a wholesale basis. 92% of the water supplied to the City goes to single family residential customers, 2% to multi-family residents, and the remaining 6% to commercial customers.

Program History

The City first recognized water conservation as an issue in its 1985 Comprehensive Water Supply Plan. The conservation programs responded primarily to water shortages or emergency situations and were coordinated with Seattle's conservation efforts. The primary target for the program was residential consumption and summer outdoor watering. The programs have included media campaigns, promotional materials, every-third-day watering calendars, conservation hotlines, a summer water patrol and water use restrictions, as required. Indoor conservation kits have also been available to customers. While these programs flatten summertime outdoor watering peaks, they provide little incentive to modify long term consumer behavior.

In 1990, the City began encouraging conservation through its rate structure. Bellevue retried its flat rate schedule to implement an increasing block rate structure,

which targets summer outdoor water consumption by raising the per unit price of water for those units in excess of normal residential use. The block rate structure more accurately reflects the true marginal cost of providing water during the summer.

Today

In 1991, Bellevue is taking a more proactive approach toward water conservation to satisfy the planning requirements of the Conservation Planning Requirements. In addition, the City is contributing to the development of regional conservation programs. The water conservation program emphasizes three main areas: the city itself, single-family residents, and youth education.

First, Bellevue hopes to lead its customers by example through improving and promoting its own water conservation efforts. This year the City is working with the its Parks Department to improve irrigation systems and reduce future water demand. The City Maintenance Department will complete a city-wide leak detection audit and repair program which began in 1990. Efforts will also be made to update current City policy and codes to reflect regional conservation goals.

In June 1991, the City will expand its current increasing block rate structure from 2 to 3 blocks to further encourage conservation and control summer peaks. The City's Parks Department and the water conservation office plan to develop a water efficient demonstration garden at the City's new botanical garden site.

For single-family residents, the long range goal is to create a water conservation ethic in the community. The need to conserve will be promoted within the City on a year round basis rather than only during the summer months. Local programs will be designed to meet the needs of City customers while supporting the larger regional conservation message. Conservation will be promoted each season, with the greatest emphasis still being summer watering. The regional effort this year includes distributing an every-third-day watering calendar and a publicity program during the summer months. Bellevue hopes to provide additional customer assistance with "how-to" classes and workshops.

A water efficient demonstration garden is being coordinated with the King County Master Gardeners at the City's Lake Hills Greenbelt Community Garden. The City also hopes to develop joint promotion of low water use landscaping through coordination with local nurseries and area businesses. Bellevue will take advantage of local theme shows, media and trade publications to promote its conservation message.

The third element of Bellevue's conservation program is youth education. A theater group will perform for Bellevue's schools again this year, bringing the water

conservation message to elementary students. The conservation message will also be included, whenever possible, in the water quality units of the City Parks Department's educational programs and storm and surface water workshops. Bellevue is actively involved with regional development of a water education work plan for students.

Plans for the City's future conservation programs will continue to be molded by state and local requirements and will be coordinated with regional water conservation activities.

Contact: Patricia Record, Water Conservation Program Coordinator, (206) 451-4127.

Appendix B

Conservation Incentive Programs in California:
Notable Examples

Santa Monica, California
BAYSAVER Fixture Rebate Program

In 1989, the City of Santa Monica, in its role as provider of both water and wastewater treatment services, started the BAYSAVER fixture rebate program to replace the fixtures in 25% of existing homes and apartment buildings. An ordinance requiring efficient fixtures in all new construction already in place.

Five incentives encourage the purchase and installation of ultra low flow toilets (1.6 gallons or less) and low flow showerheads (3 gallons a minute or less):

1. To increase the acceptability of the ultra low flow toilets, the City distributed 700 toilet and showerhead packages to selected participants for free. The toilet/showerhead packages cost the city $75 each.

2. For each bathroom in which the fixtures are replaced, the City will offer a $100 rebate to the owner.

3. As an alternative to a rebate, low cost installation and free toilets were offered to eligible property owners. This program equalled the cost of the rebate, $25 for the installation and $75 for the toilet and showerhead.

4. More efficient fixtures can reduce water and sewer costs to consumers by up to 30%. As a result of reduced water and sewer bills the net costs of the toilet and showerhead (the costs after the rebate) can be recovered in 1 to 3 years.

5. The City works closely with plumbing contractors to provide reasonably priced installation and other information to customers. Promotional events, training for do-it-yourself customers, cooperative advertising opportunities, display materials, and product training for plumbing contractor employees are provided by the City. A list of reasonably priced plumbing contractors was produced and is included in the package of materials produced for customers by the City.

Starting July 1, 1990, a conservation incentive fee has been added to the water bills of homes and apartment buildings not yet converted to the more efficient fixtures. The conservation incentive fee is $0.65 per apartment unit and $1.00 per

single family home per month. In addition to penalizing customers with inefficient fixtures, the fee helps fund the conservation program.

Property owners or managers who apply to the program are sent a package of information which includes a listing of where to get low flow fixtures, which models of ultra low flow toilets are approved by the City of Santa Monica, product information, a list of reasonably priced plumbing contractors, magazine articles on the effectiveness of ultra low flow toilets, and a rebate form.

The BAYSAVER rebate program is funded by the conservation incentive fee (50% of the program cost), general water revenues (25% of program costs), and a conservation credits program grant from the Metropolitan Water District of Southern California (25% of program costs). The Metropolitan Water district supplies Santa Monica with its water and has started the conservation credits program in order to encourage conservation by the systems it supplies. The rebate program is scheduled to continue for five years. A private contractor provides rebate processing and inspection services for the City.

The City has an innovative plan for recycling customer's old toilets. The toilets will form the base for a reef that will provide habitat for marine life in Santa Monica Bay!

As of September, 1990, the City has processed rebates for 3800 toilets.

Contact: Atossa Soltani, Conservation Coordinator, City of Santa Monica, Environmental Division, 1685 Main Street, Santa Monica, CA 90401. (213) 458-8229.

North Marin Water District
Connection Discount Fees/Rebates for Low Water Landscaping

The North Marin Water District has been a long time leader in low water landscape programs. In 1985, the District researched how low water landscapes compared to traditional landscapes in relation to the amount of water used, landscape labor, fertilizer and herbicide use, and fuel for lawn cutting and transportation of grass clippings. The research project looked at water and other resource use over the course of the entire irrigation season (from March 1 to November 15).

The results of the study were impressive. The comparison between traditional landscaping and low water landscaping showed the following savings:

	% of Savings Compared	Annual Savings

	to Traditional Landscape	in $ Per Dwelling Unit
water	54%	$28.37
labor	25%	36.69
fertilizer	61%	8.80
fuel	44%	0.96
herbicide	22%	0.18
		$75.00

Outside watering accounts for 40% of all water use in the North Marin service area, but outside use increases during the peak demand month to 65%. Lawn watering uses about 75% to 90% of all water used outside. To reduce outside water use, the District has developed a connection fee discount and a rebate for conversion of existing turf to a low water landscape.

To qualify for a connection fee discount, an applicant must not install more turf than the goal set by the District: <800 sq. ft. per single family home, <400 sq. ft. per townhouse or condominium, and <200 sq. ft. per apartment unit. The discount on the connection fee for new construction is based on reduction in the amount of water use during the peak demand month by the dwelling type. The rebate for conversion of existing landscape is $50 per 100 sq. ft. of irrigated turf replaced with hardscape (concrete or asphalt) or low water using plants. Both the fee discount and the rebate cost the utility money. However, the cost per unit of water saved is less than the cost of adding additional supply capacity required to meet peak demand.

Through a combination of connection fee discounts and rebates, which will reduce the amount of turf area normally installed by 40%, peak month demand can be reduced by 19% and average annual demand will be reduced by 12%. The connection fee discounts and rebates combined with the savings realized from a reduction in water, labor, chemical and fuel use make conversion a worthwhile investment for the customer.

Contact: Ali Davidson, Water Conservation Specialist, North Marin Water District. Ms. Davidson's office is at the Sonoma County Water Agency, 2150 West College Ave., Santa Rosa CA 95401 (707) 524-3774.

Appendix C

Water Conservation Ideas to Pass on to Residential Customers

INDOOR WATER CONSERVATION IDEAS

In the Bathroom:

1. Take short showers

   Turn on the shower to get wet, turn it off and soap and shampoo, then turn on the water again to rinse. Remember: saving hot water saves energy and reduces energy bills!

2. Don't use the faucet or shower at full pressure.

3. Turn off the faucet when shaving, brushing teeth, washing vegetables, or washing dishes by hand.

   Using a small tub or a partially filled sink for washing vegetables and dishes is a great water saver.

4. Install low flow showerheads or showerhead restrictors.

   Low flow showerheads should produce a water flow between 2 and 2.5 gallons of water per minute, which is 25-75% less than a conventional shower. Showerhead restrictors are small plastic or metal washers that reduce the flow of water through the shower by partially blocking the opening in the showerhead. Shower heads and restrictors can be purchased at most hardware and home improvement stores.

5. Don't use the toilet as a waste basket.

6. Install toilet retrofit devices.

   These devices don't save as much water as an ultra low flow toilet will, but they will reduce the amount of water used by existing toilets. These devices work by displacing some of the water in the tank so that each flush uses less water. Retrofit devices include:

   Toilet displacement bags--clear plastic bags filled with water and placed in the tank;

Toilet dams--plastic or metal dams affix to the walls of the tank to block off part of the tank from refilling after each flush;

Displacement bottles--bottles filled with water and some sand or gravel for weight and placed in the tank away from moving parts;

Flushing devices--a number of devices are on the market which reduce the amount of water conventional toilets use in flushing by closing off the flow of water from the tank to the bowl sooner.

Many water utilities will supply these devices to their customers.

7. Install ultra low flow toilets.

   Ultra low flow toilets use 1.6 gallons per flush or less, compared to 5-7 gallons used by conventional toilets. Studies have found that the ultra low flush toilets are actually better designed than the 3.5 gallon per flush toilets. Ultra low flow toilets can save between $20 and $60 a year in water and sewer bills, depending upon local water sewer rates.

8. Fix leaks in all toilets.

   To check for leaks, put a few drops of food coloring in the tank. After 15 minutes, if any of the coloring shows up in the bowl, there is a leak. The flapper valve that separates the tank from the bowl needs cleaning or replacement. If water is running down the overflow tube, bend the float arm slightly downward (be careful not to break it) so that it touches the surface of the water sooner and shuts off the flow of water down the tube.

<u>In the Kitchen:</u>

9. Keep a bottle of drinking water in the refrigerator.

   This is an alternative to turning on the tap and letting the water run until it is cold for every glass of water.

10. Don't use or install in-sink garbage disposals.

    These devices eat up about 11.5 gallons of water each day. Encourage resource saving composting of organic wastes instead.

11. Buy a faucet aerator.

These handy and inexpensive devices save water and water heating costs too. Aerators add air to the water flow which reduces the amount of water that passes through the faucet per minute. Some aerators allow the faucet head to swivel which aids in rinsing out the sink, washing vegetables, etc. Also, consider adding faucet flow control and regulating devices that reduce the amount of water that flows through the faucet per minute.

12. Buy water efficient dishwashers and washing machines.

Purchase the most efficient, least water consumptive appliances possible. Many retailers use stickers to identify the most efficient models. But any extra efficiency these appliances may produce depends upon their proper use. Washing only when there is a full load is necessary to obtain the most efficiency from any appliance. Look at the Energy Guide label on the appliance to see how much water the machine uses.

In General:

13. Fix all water leaks.

A slow, steady drip can waste 75 gallons a week!

14. Check the water pressure.

If it is above 50 pounds per square inch, it is probably unnecessarily high and a plumber can install a pressure reduction valve. A pressure reduction valve will reduce the rate at which water flows through the plumbing fixtures.

OUTSIDE WATER CONSERVATION IDEAS

1. Water the lawn for longer periods but less frequently.

This saves time spent on frequent watering and saves money otherwise spent treating lawn diseases caused by over-watering. Watering lawns less often but for a longer period of time encourages the grass to grow longer roots, which makes the lawn more drought resistant. The general rule is to water long enough for the water to penetrate the ground about 4-6 inches once a week. The sprinkler should distribute water evenly and only where it is needed.

2. Water in the evening or early morning and when the wind is not blowing.

This reduces evaporation.

3. Remove thatch and weeds.

   This allows water and air to reach the roots of the grass. Poking holes in the soil (aeration) also allows the roots to get water.

4. Water shrubs and plants separately from the lawn.

   Plants have different needs than lawns and may be over watered if watered at the same time as lawns.

5. Apply water only as fast as the soil can absorb it.

6. Buy garden hose nozzle adapters.

   Nozzle adapters that shut off the flow of water when the hose is not in use can save water and reduce trips to the faucet. The best adapters will not leak even though water is flowing through the hose.

7. Use low water using native and ornamental plants in landscaping.

   Consult with the county co-op extension agent, nursery owners, libraries, landscapers, and garden and plant clubs in your area for the names of suitable plants. Some native and low water plants require less fertilizer and maintenance than lawns and non-native plants.

8. Use mulches to cover the ground around plants.

   This will help keep moisture in the ground and will help keep weeds down. Weeds compete with desirable plants for water.

9. Consider changing to a drip irrigation watering system for non-turf areas.

   Soaker hoses or underground sprinkler systems are better than applying water directly to the root zone. Direct application to the root zone improves efficiency and is healthier for some plants.

10. Wash cars and outside windows with a bucket.

    Using a bucket of soapy water for the wash and a bucket of clean water for the rinse will drastically reduce water use compared to using a hose to wet, wash, and rinse.

11. "Dry Clean" sidewalks and driveways.

Sweeping sidewalks and driveways instead of hosing them down is a big water saver.

12. Clean gutters and downspouts by hand instead of using water.

13. Replace leaky or broken sprinklers and sprinkler heads promptly.

Appendix D

Introduction to Low Water Use Landscaping

Low water use landscaping (also known as Xeriscaping) is the practice of applying certain landscaping principles to the creation and maintenance of a landscape to reduce the amount of water used. In addition to reducing water use, research shows that low water use landscaping can reduce the amount of labor, fuel and chemicals used in maintaining the landscape[2].

The seven fundamentals of low water use landscaping are:

1) **Soil Improvement**--Adding organic matter to the soil will allow the soil to retain more water and will also provide the plant with needed nutrients. Organic material should be worked into the soil to create a crumbly texture. Lawns need organic matter mixed into the soil to a depth of 6-8", annuals need organic matter mixed into the soil to a depth of 8-10" and perennials and shrub borders should have organic matter mixed into the soil to a depth of 18-24".

2) **Appropriate Use of Turfgrass**--Lawns are largest water user, compared to other landscaping plants. Choosing the location and size of the lawn, the appropriate grass species for the area, the proper watering, and proper maintenance programs are keys to a low water use lawn. Smaller, rounded shape plots of lawn on flat areas are easiest to water efficiently. Water requirements and the cutting height of each grass will vary between species and site. Local WSU Co-operative Extension Agents can assist in the selection of grass species and provide information on proper maintenance.

3) **Efficient Irrigation**--There are a variety of irrigation technologies to choose from: drip, timed sprinklers, un-timed sprinklers, and hand watering. Efficiency in any irrigation system is attained by keeping the system in good working order, adjusting the sprinkler heads or drip emitters so that water is applied only to the landscape (not the driveway), and applying water only as plants need it.

One method to determine a plant's water needs is to use evapotranspiration (often called ET) information. Evapotranspiration refers to the two ways in which plants lose moisture. Evaporation is the natural loss of water to the air from the soil, water surfaces, and other non-living materials. Transpiration is the loss of water through the plant during the plant's life and growth process. ET

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[2] based on the findings of the North Marin Water District. For further information see "Water Conserving Landscapes Show Impressive Savings", by John Olaf Nelson, Journal AWWA, March 1987.

information is used to regulate the irrigation of plants so that the amount of water applied is equal to the amount of water lost through evapotranspiration at different times of the year, instead of applying a fixed amount all year long. Some water utilities and local parks departments are using ET data to manage irrigation systems.

Information on how to determine the proper amount of water to apply to landscaping is available from local WSU Co-operative Extension Agents. Soil moisture meters can also aid in determining the amount of water to apply.

4) **Use of Mulches**--Mulches reduce the amount of moisture that evaporates from bare ground. Organic mulches include wood chips, bark, straw, grass clippings, peat moss, pine needles and seed and nut hulls. Inorganic mulches include rock, gravel, decomposed granite, brick chips and coarse sand. Man-made mulches are also available but be careful to use only those that let water and air pass through. Mulches should be spread a few inches thick around the base of shrubs and trees or anywhere bare soil is exposed.

5) **Selection of Low Water Use Plants**--Plants should be selected that thrive in the micro-climate of the site: the high and low temperatures, soil types, available sunlight, humidity, and natural precipitation. Plants native to the region or from other geographic areas with similar climates are the best choice. Some plants from Mediterranean climates also do well here. It is important to note that some low water use plants may have certain needs, such as shade, and placing these plants in areas where these needs aren't met can lead to increased water use. A number of good reference materials on plant selection and low water landscape design are listed in this bibliography.

6) **Planning and Design**--As a rule of thumb, plants with similar water needs should be grouped together in order to design an irrigation system that can efficiently provide different amounts of water to each grouping. Landscape design should also consider the needs of the plants, so that shade and sun are available for different plants. Plants native to a region work well in nature because of complex interrelationships. Native plants used in a landscape may require more attention to placement in order to re-create some of these interrelationships.

The design should also allow for maintenance activities. Plants needing particular care should be easily accessible. Aesthetic considerations such as color, framing views, and screening should also be included in the design.

7) **Appropriate Maintenance**--Many of the lower water use varieties of grass should be allowed to grow taller than traditional grass. Taller grass results in more shade for the soil and less evaporation. Aerate the turf and periodically remove thatch to allow more water to reach the roots.

Fertilization of lawns and plants should be done infrequently and in the fall or early spring. Fertilizer should be chosen to complement the soil type.

Weeds require a great deal of water and compete with other plants. During the first growing seasons, even low water use plants will have higher water requirements as the plants become established. Hand weeding is best to remove most of the weed with the least damage to the soil. Weeding during the first growing seasons of a new landscape is especially important. Once the landscape is established, mature ground cover plants and mulches will discourage weeds by blocking access to the soil.

Correct pruning to remove dead or diseased growth and to promote the plants natural shape may reduce the plants water demands.

Planting in the fall encourages drought tolerance in plants.

Whether designing a new landscape or changing an existing landscape, these seven low water use landscaping fundamentals can be applied to any site. It is important to know about the soils, climate, natural precipitation, and topography of the site before starting to design a low water use landscape. Some of this site information can be obtained from county extension agents and the local office of the National Weather Service. For additional information on low water use landscaping, please refer to the bibliography below.

Resource List of Low Water Use Landscaping Materials

What is Low Water Use Landscaping?

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Nelson, John Olaf, "Water Conserving Landscapes Show Impressive Savings", Journal AWWA, March 1987. This article illustrates the water, fuel, labor, fertilizer and herbicide savings achievable through low water landscaping.

Nelson, John Olaf, "Why Turf Requires So Much Water", May 1990. Copies of this paper cost $1.00 and are available by contacting the North Marin Water District, 999 Rush Creek Place, Novato CA 94945, (415) 897-4133.

Sonoma County Water Agency, "Xeriscape", 2150 W. College Ave., Santa Rosa CA 95401, (707) 526-5370. This booklet contains illustrated xeriscape designs and a plant list.

Low Water Use Demonstration Gardens

Seattle Water Department has sponsored low water use demonstration gardens at the Northwest Flower and Garden Show. The Show is usually in February. For information Seattle's previous involvement in the Flower and Garden Show, contact the Seattle Water Department's Conservation Office (206) 684-5879.

The grounds at Children's Hospital and Medical Center, especially the buffer strips in parking lot 4, are planted using low water use plants. The Hospital is located at 4800 Sand Point Road Way Northeast, in Seattle. For further information on the grounds, contact David Johnson (206) 527-3889.

Redmond Public Works Department is sponsoring a low water use garden in front of the Redmond City Hall. For further information on the garden and to obtain a plant list, contact the City of Redmond's Conservation Office (206) 882-9709.

Seattle Tilth has a drought tolerant planting near their offices at the Good Shepard Center, 4649 Sunnyside North, Seattle. The planting is located on the right hand border of the main walk way. For further information on the planting, contact Howard Stenn (206) 324-4743.

A new demonstration garden has been built in Legion Memorial Park, located at the intersection of Alverson and 2nd Street in the City of Everett. The garden was designed by interns from the Washington State Landscape Architecture program and used plants from the low water use demonstration garden at the 1991 Flower and Garden Show. Interpretive signs will be added to the garden and educational offering associated with the garden will be offered next year. For further information on the garden, contact Pam Roy of the City of Everett Parks Department, (206) 259-0300.

Local Experts

The Center for Urban Horticulture at the University of Washington has a marvelous library for low water use landscaping materials. The Elisabeth C. Miller Library has made researching low water use landscaping easy by collecting relevant articles in easy-to-use subject files and preparing booklists on the subject. The Center also has a speakers bureau which can be accessed for lectures on aspects of low water use

landscaping and offers classes related to water efficient gardening and landscaping. Contact the Center at (206) 543-8616 for more information.

The Washington State University Cooperative Extension Service has a variety of resources available. Aside from the resource of the extension agent in each county, who can field questions on low water use landscaping, the Extension Service maintains a list of speakers and operates the Master Gardener program. Both the King County and Pierce County Extension offices have speakers lists. For further information, cal King County at (206) 296-3900 or Pierce County at (206) 591-7180.

The Master Gardener program, offered by the Cooperative Extension Service, can be contacted by phone to answer questions directly or callers can ask to hear one of several tapes on landscaping topics. For further information on these services, contact your local extension agent.

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Robinette, Gary O., Water Conservation in Landscape Design and Maintenance, Van Nostrand Reinhold, New York, 1984, 258 p.

Gottehrer, Dean M., Natural Landscaping, Dutton, New York, 1978, 182 p.

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Sunset Books, Water Wise Gardening, Lane Publishing Co., Menlo Park CA 1989

Welsh, Douglas F., Landscape Water Conservation: Xeriscape, Texas Agricultural Extension Service, College Station TX, 1988, 9p.

Taylor's Guide to Water Saving Gardening, Houghton Mifflin, Boston, 1990, 447 p., part of the Taylor's Guides to Gardening series

Kruckeberg, Arthur, Gardening with Native Plants of the Pacific Northwest: an Illustrated Guide, University of Washington Press, Seattle, 1982, 252p.

PlantMaster, Gerry Kiffe of Acacia Software, P.O. Box 90525, Santa Barbara CA 93190, (805) 964-7497. This software can help both landscape architects and water utility managers choose California native plants and other drought resistant plants for use in low water landscapes. The plants are cross referenced for soil type, height, etc.

Brooklyn Botanical Garden, Low-Maintenance Gardening: A Handbook, Spring 1983 issue of Plants and Gardens, vol. 40, number 1, #100.

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Cooperative Extension, "Saving Water--Lawns and Other Turf", Washington State University, 1977. Available for a small fee from your local Cooperative Extension Agent or contact: Bulletin Dept., Cooperative Extension, Cooper Publications Bldg., Washington State University, Pullman WA 99164-5912.

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Diekelmann, John & Schuster, Robert, Natural Landscaping: Designing with Native Plant Communities, MacGraw-Hill, 1982.

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Developing Low Water Landscaping Programs

Ball, Ken, Xeriscape™ Programs for Water Utilities,American Water Works Association, 1990, 91 p.

California Department of Water Resources, Landscape Water Conservation, Guidebook No. 8, March 1988. This guidebook covers the basics of a low water landscaping program, from lawn watering to plant tagging. Available from: Department of Water Resources, Central Records, P.O. Box 942836, Sacramento CA 94236-0001, (916) 445-9371.

National Xeriscape™ Council, Inc., P.O. Box 163172, Austin TX 78716-3172, (512) 392-6225. This group can assist in the development of a low water landscaping program and can supply information educational information. This group is supported by memberships. The word "xeriscape" is copyrighted by the Council and commercial use of xeriscape material must be authorized by the Council.

National Wildflower Research Center, 2600 FM 973 North, Austin TX 78725. publishes fact sheets, recommended species lists, source lists, gardening and landscaping tips, and bibliographies for different states.

Nelson, John Olaf, "Promoting Less Turf with Connection Fee Discounts and Rebates", June 21, 1989. Copies of this paper cost $1.00 and are available by contacting the North Marin Water District, 999 Rush Creek Place, Novato CA 94945, (415) 897-4133.

Nelson, John Olaf, "Cash for Grass", June 1990 and "Report on Results of One Year Pilot Project on 'Cash for Grass'", January 30, 1991. Copies of these papers cost $1.00 and $4.50, respectively, and are available by contacting the North Marin Water District, 999 Rush Creek Place, Novato CA 94945, (415) 897-4133.

Booklets on "How to Have a Green Garden in a Dry State", drip irrigation, and low water use turf grass are available from the Metropolitan Water District in California. Write to: Green Garden, Metropolitan Water District, P.O. Box 54153, Los Angeles CA 90054-0153.

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Johnson, David, "Appropriate Plants for Northwest Landscapes", Washington Toxics Coalition, 4516 University Way NE, Seattle, WA 98105, (206) 632-1545. This publication is available the Coalition. David Johnson is Director of Grounds Maintenance at Children's Hospital and Medical Center in Seattle and is a past president of the Western Washington Tilth Assoc. and Seattle Tilth.

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Appendix E

Outline for an Audit of Water Use in a Residence

A residential water audit is a very effective means to increase water use efficiency. An audit allows the public water system to gather information on how water is used in the service area and allows the distribution of conservation information and installation of devices. Installing conservation devices for customers can improve the efficiency of a retrofit program. Audits which include installation of conservation devices provide the public water system with a more accurate record of the number of devices installed, in contrast to a retrofit program in which devices are delivered by mail or picked up by customers and installed by the customers.

A process for informing the public about the availability of an audit should emphasize the savings on their water bills that customers will experience as a result of the audit.

Staff should conduct the audits in teams of two or more and should have a set route. Identification cards should be carried by the audit staff to be shown to residents. **Audit staff should <u>always</u> explain the tasks that they will be performing before they begin. Ask the permission of the resident before performing parts of the audit that require altering fixtures.**

The following outline suggests the type of activities that are performed as part of a residential audit. The actual content of an audit will depend upon the other conservation measures the public water system is pursuing.

I. Service Meter
(optional if a program of regular maintenance is already in place.)

A. Calibration/Flow Test

B. Leak Test

1. Ask customer to turn off all water using appliances in the home.

2. Check the meter dial. If it is still moving, there is a leak in the service line that should be repaired promptly.

II. Kitchen

A. Check the rate of flow from the faucet.

1. Turn the faucet fully open

2. Using a watch with a second hand or a stop watch, time how many seconds it takes to fill a one gallon jug.

3. Divide 60 by the number of seconds it took to fill the jug. For example, if it took 15 seconds to fill the jug, divide 60 by 15. The rate of flow is 4 gallons per minute.

B. Offer to install an aerator or restrictor for the customer if the flow is greater than 3 gallons per minute.

C. Check for drips and leaks in the fixture.

III. Bath

A. Shower

1. Check shower flow rate.
Use the method described above.

2. Offer to install a showerhead or flow restrictor if the flow is greater than 3 gallons per minute.

3. Check for drips and leaks.

B. Sinks

1. Check sink faucet flow rate.

2. Offer to install an aerator or flow restrictor if flow is greater than 3 gallons per minute.

3. Check for drips and leaks.

C. Toilets

1. Check for leaks.

a. Place a dye tablet or a few drops of food coloring in the tank. Do not flush the toilet.

b. After ten minutes, look in the bowl. If colored water is present, there is a leak.

c. Clean or replace the flapper that controls the entrance of water from the tank to the bowl.

d. Check the adjustment of the float arm. The ball on the end of the float arm should touch the surface of the water. No water should be running down the overflow tube.

2. Offer to install toilet retrofit devices or offer information on rebates for ultra low flow toilets.

IV. Outside Water Use (if audit is conducted in the summer)

A. Measure the flow rate of the sprinklers.

B. Check for leaks in the sprinkler, hose, or sprinkler system.

C. Check the position of the sprinklers. Determine whether the sprinklers cover only the area to be watered or whether the sprinklers need adjustment to prevent water from falling on homes, sidewalks, and other areas.

D. Instruct the resident on how to figure the length of time necessary for water to reach the root zone of lawns.

1. Show the resident how to identify the root zone.

2. Inform the resident that water should be applied slowly (to prevent runoff) until the water as reached the bottom of the root zone.

3. Instruct the resident to time how long it takes for water to reach the roots.

E. Help the customer develop a watering schedule in which the following items are identified:

1. Any restrictions on watering imposed by the local government.

2. The best time of day to water--either early morning or after the sun has gone down.

3. The number of days each week to water.

   a. Water only when the lawn does not spring back when stepped on.

   b. The rule of thumb for Western Washington is to apply water to reach the root zone once a week.

4. The length of time to water. This will depend on how long it takes for the customer's sprinkler to apply the correct amount of water to penetrate the root zone.

F. Inform customers about the low water landscaping, i.e. which plants use little water, where to buy such plants, how to group the plants on the site.